Town of Montague

Water Pollution Control Facility
34 Greenfield Road
Montague MA 01351-9522
WPCFSUPT@MONTAGUE.NET

(413) 773-8865
FAX: (413) 774-6231

Environmental Protection Agency
Water Technical Unit (SEW)
P.O. Box 8127
Boston, MA 02114

6 November 2009

RE: NPDES Permit MA0100137, Effluent Nitrogen Reduction

To whom it may concern:
Enclosed is the report as required by the NPDES Permit, Part 1.H, Special Conditions.

"Within **one year of the effective date of the permit,** the permittee shall complete an evaluation of alternative methods of operating the existing wastewater treatment facility to optimize the removal of nitrogen, and submit a report to the EPA and Mass DEP documenting this evaluation and presenting a description of recommended operational changes. The methods to be evaluated include, but are not limited to, operational changes to enhance nitrification (seasonal and year round), incorporation of anoxic zones, septage receiving policies and procedures, and side stream management. The permittee shall implement the recommended operational changes in order to maintain the existing mass discharge loading of total nitrogen. The annual average total nitrogen load from this facility (2004 – 2005) is estimated to be 172 pounds/day."

The following report is divided into sections addressing the individual tasks noted in the report requirements listed above.

I. "Within **one year of the effective date of the permit,** the permittee shall complete an evaluation of alternative methods of operating the existing wastewater treatment facility to optimize the removal of nitrogen, and submit a report to the EPA and Mass DEP documenting this evaluation and presenting a description of recommended operational changes. The methods to be evaluated include, but are not limited to, operational changes to enhance nitrification (seasonal and year round), incorporation of anoxic zones, septage receiving policies and procedures, and side stream management."

An evaluation of alternative methods of operating the existing wastewater treatment facility to optimize the removal of nitrogen was completed as part of the Preliminary Engineering Report dated 2006 by Camp Dresser & McKee (CDM). Excerpts addressing nitrogen removal from that report are contained herein. In summary the report notes that a process known as the Modified Ludzack-Ettinger process would be a cost-effective process for the reduction of nitrogen discharged to the Connecticut River from the WPCF. The process provides for increased aeration capacity, added tank volume of 700,000 gallons; existing aeration tank volume is 460,000 gallons. This would include new pumps piping and submersible mixers associated with the expanded volume. The estimated cost, 2006, was $4,500,000. This report was previously submitted to both the EPA and DEP as part of the

workup towards the Combined Sewer Overflow and WPCF Upgrade project. As part of the septage receiving policies and procedures a new septage receiving addition to the existing septage tank was proposed. The system involved a screening and degritting device that would have removed debris prior to pumping into the facility. Due to increased costs this improvement was eliminated from the project. It was envisioned that the processed septage would be sent directly to the sludge holding tanks and processed through the proposed upgrade to the biosolids handling system. In this way the septage load to the secondary treatment process would be greatly reduced. It was expected that the amount of nitrogen compounds sent through the entire facility would be less than at present. Policies to reflect the change due the deletion of the septage upgrade from the project have therefore not been addressed; the current practice of septage handling will be continued. That practice involves the metered pumping of septage into the facility overnight and holding septage until the weekend to help level load the WPCF when certain industries shutdown. Side stream management involves:

- Operations Building floor drainage back to the headworks, minimal.
- Sludge holding tank decanting back to the headworks, minimal.
- Wasting biosolids from the secondary treatment system to the influent to the primary treatment system. This is a standard practice that may be modified when the solids handling upgrade is on line. Modification would be to send the waste activated sludge directly to the gravity thickener vs. mixing with primary sludge then being pumped from the primary clarifiers to the gravity thickener.
- Overflow of the gravity thickener to the secondary treatment system. This may be modified when the solids handling upgrade is on line by reducing/eliminating any gravity thickener overflow to the secondary system.

II. The permittee shall implement the recommended operational changes in order to maintain the existing mass discharge loading of total nitrogen. The annual average total nitrogen load from this facility (2004 – 2005) is estimated to be 172 pounds/day."

Operational changes to reduce the quantity of nitrogen compounds discharge in the facility effluent to the Connecticut River were instituted in July of 2008. In summary the changes made since July 2008 resulted in the reduction of total nitrogen load from the facility of 53%. This is based on the estimated 2004 – 2005 172 pounds/day compared to the 2009 (January through September) estimated 81 pounds/day.

- 22 July 2008 – Change from aeration flow pattern from tank plug flow to stepped feed. Associated with this change the air feed to the end of the aeration tank was reduced. Alkalinity in the aeration tank change from an average of 85 parts per million (ppm) 2007 average to 109 ppm 2008 average. The alkalinity average for 2009 through September was 137 ppm.

- 2009 – We began to move the secondary treatment process from conventional waste activated towards extended aeration process control.
  12 March, began calculating wasting based on an 8 day sludge age.
  1 June, began calculating wasting based on a 9 day sludge age.
  30 July, Began to calculate wasting on an 11 day sludge age. The aeration tank dissolved oxygen control system setpoint was changed from 1 ppm to .4 ppm.

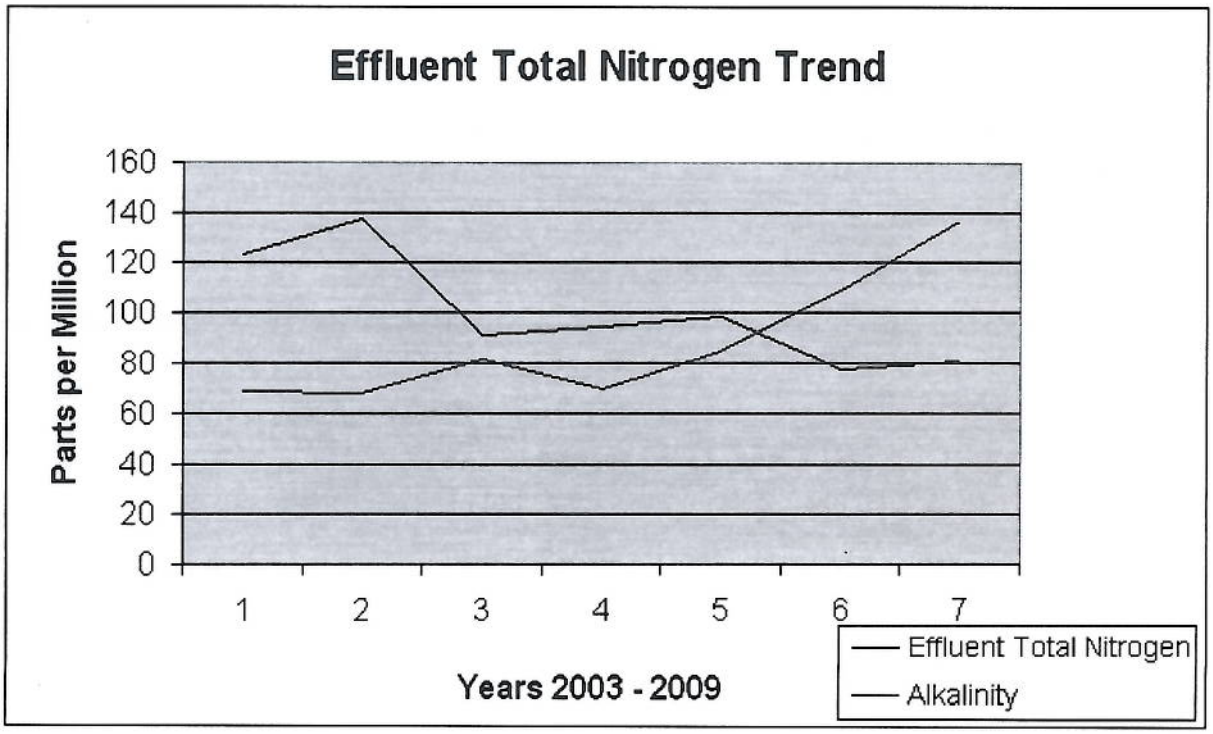
These changes have resulted in a 53% reduction in the pounds of total nitrogen discharged to the Connecticut River. Trend charts are attached that demonstrate the changes over time

for various process parameters. We intend to continue to reduce the amount of total nitrogen discharge from the facility. The extended aeration process has not been operated through a cold weather season, the coming winter will provide the opportunity to test system nitrogen removal.

I have included below data representing the trends in nitrogen discharge and process control from 2003 through September 2009.

NPDES Report 2009 Pg 15 Part 1H

Calendar Yr	N Total Lbs	Alkalinity
	Average	Aeration Tank
	ppm	ppm
2003	123	69
2004	138	68
2005	91	82
2006	95	70
2007	98	85
2008	78	109
2009	81	137
Avg.	100	89
Min.	78	68
Max.	138	137



Notes:
- 22 July 2008 changed from plug flow to step feed.
- Began to move towards extended air process control:
  - 12 March 2009 began to calculate wasting based on an 8 day sludge age.
  - 1 June 2009 began to calculate wasting based on a 9 day sludge age.
  - 30 July 2009 began to calculate wasting based on an 11 day sludge age.

Calendar year 2009 reflects data through September.

Calendar Year	Sludge Age Secondary Days	Dissolved Oxygen Aeration Tank ppm	Food/Mass Ratio Secondary Treatment	Sludge Volume Index
2003	5.9	2.9	0.33	144
2004	7.1	1.7	0.36	140
2005	7.4	1.3	0.3	130
2006	7.8	1.4	0.33	135
2007	8.4	1.3	0.44	161
2008	7	0.85	0.3	143
2009	10.4	0.5	0.13	188

Should you have any questions please contact me.

Respectfully,

Robert J. Trombley, Superintendent

pc: Selectboard
Town Administrator
WPCF Staff
Mass DEP

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Town of Montague

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(413) 773-8865
FAX: (413) 774-6231

Water Technical Unit
U.S. Environmental Protection Agency
P.O. Box 8127
Boston, MA 02114

20 March 2009

RE: NPDES MA0100137

To whom it may concern:
In accordance with the NPDES Permit Part 1 H. Special Conditions the following information concerning nitrogen removal at the WPCF is provided.

Efforts to reduce the discharge of Total Nitrogen into the Connecticut River began in July of 2008. During the month of July the secondary treatment process was changed. The aeration system for many years had been operated in a plug flow configuration, this was changed to step feed. The air to the diffusers in the aeration tank was throttled down at the end of the tank with the intent to push the system towards denitrification just prior to overflowing from the aeration basins to the secondary clarifiers. When comparing calendar year 2007 results to 2008 results there is a slight decrease in the average concentration for all species of nitrogen tracked. The attached data sheet and graphs bear this out. The overall reduction of total nitrogen (nitrate/nitrite + Kjeldahl nitrogen) calculates out to be a 21% reduction. The NPDES permit notes that "the annual average nitrogen load from this facility (2004-2005) is estimated to be 172 lbs/day." The 2008 estimate is 77 pounds per day. We are continuing to experiment with process changes in an effort to further reduce the nitrogen load to the river.

Should you have any questions please contact me.

Respectfully,

Robert J. Trombley, Superintendent

pc: Town Administrator
Selectmen
WPCF Staff
DEP

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Town of Montague

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Water Technical Unit
U.S. Environmental Protection Agency
P.O. Box 8127
Boston, MA 02114

12 February 2010

RE: NPDES MA0100137

To whom it may concern:
In accordance with the NPDES Permit Part 1 H. Special Conditions the following information concerning nitrogen removal at the WPCF is provided.

Efforts to reduce the discharge of Total Nitrogen into the Connecticut River began in July of 2008:

- Aeration tank flow changed from plug to stepped feed, 22 July 2008.
- Alkalinity changed from 2007 average = 85 ppm to 2008 = 109 ppm.

We continued to change the process control of the secondary treatment system in 2009:

- 12 March, sludge age wasting calculation based on 8 days.
- 1 June, sludge age wasting calculation based on 9 days.
- 30 July, sludge age wasting calculation based on 11 days. Aeration tank dissolved oxygen setpoint changed from 1 ppm to .4 ppm.
- 17 November, sludge age wasting calculation based on 12 days.
- 2 December, sludge age wasting calculation based on 15 days.

The NPDES permit notes that "the annual average nitrogen load from this facility (2004-2005) is estimated to be 172 lbs/day." There was an increase in the average total nitrogen pounds per day from 2008 to 2009 of 48 lbs (50% increase). When comparing the 2009 average total nitrogen pounds per day to the NPDES value there remains a reduction of 57 pounds (33% reduction). We are continuing to experiment with the extended air process in an effort to further reduce the nitrogen load to the river.

Should you have any questions please contact me.

Respectfully,

Robert J. Trombley, Superintendent

pc: Town Administrator
Selectmen
WPCF Staff
DEP

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U.S. Environmental Protection Agency
Water Enforcement, OES4-5MR
5 Post Office Square, Suite 100
Boston, MA 02109-3912

2 March 2011

RE: NPDES MA0100137, Annual Nitrogen Report, 2010

To whom it may concern:
In accordance with the NPDES Permit Part 1 H. Special Conditions the following information concerning nitrogen removal at the WPCF is provided.

The NPDES permit notes that "the annual average nitrogen load from this facility to the Connecticut River (2004-2005) is estimated to be 172 lbs/day."

History prior to 2010

2008

Efforts to reduce the discharge of Total Nitrogen into the Connecticut River began in 2008:

- Aeration tank flow changed from plug to stepped feed, 22 July 2008.
- Alkalinity changed from 2007 average = 85 ppm to 2008 = 109 ppm.

2009

- 12 March, sludge age wasting calculation based on 8 days.
- 1 June, sludge age wasting calculation based on 9 days.
- 30 July, sludge age wasting calculation based on 11 days. Aeration tank dissolved oxygen setpoint changed from 1 ppm to .4 ppm.
- 17 November, sludge age wasting calculation based on 12 days.
- 2 December, sludge age wasting calculation based on 15 days.

Report on reduction efforts 2010

The NPDES permit required testing frequency for effluent nitrogen levels is once per month. We have performed two per month except for October & November where one/month was done; also tested was the influent sewage as well, the data is enclosed with this report. The target sludge age has been gradually increased over time. This age increase has been done in an effort to meet extended air process control conditions of the secondary treatment system with the goal of reducing the pounds of biosolids to be disposed. We have had some success with this shown by the reduction in the dry tonnage of solids produced and the concurrent expenditure reduction. In fiscal year 2010 the estimated tonnage and budget figures were 695 tons at a cost of $355,000 but the actual were 410 tons for $206,723. There were some

industrial loading changes that also affected these figures. Concurrent with the impact of solids reduction is the effect on total nitrogen discharged, the average for 2010 while lower than 2009 is higher than we had hoped. In calendar year 2010 the sludge age again was adjusted:

- 23 March, increased to 13 days.
- 12 May, increased to 15 days.
- 3 July, increased to 17 days.
- 30 December increased to 20 days.

Sludge age changes have been made slowly over time to allow for the observation of process changes. There is also the concern that while the extended air process has provided the opportunity to realize savings for the Town there is also a level of risk involved. The risk level has to do with higher than normal secondary clarifier blankets due to the solids inventory in the secondary system as a result of the extended air process. When the higher blankets are present and you overlay the combined sewer overflow upgrades of recent years the prospect of solids washout due to increase WPCF flows exists during wet weather events. The process of monitoring and reacting to changes to safeguard the National Permit Discharge Elimination System limit requirements therefore is more complicated than it would otherwise be. We have recently, 2 February 2011, modified the aeration tank (AT) air distribution pattern. Inlet air has been shut off at the head of the AT and is now fed towards the end with the goal of further reducing the total pounds of nitrogen discharge to the Connecticut River. Be advised that as part of the CSO project a new dewatering system, Fournier rotary press will be installed and brought on line in June 2011. This will impact the process as the pressate from the dewatering process will be returned to the facility, this is in contrast to having it hauled away as a part of the thickened sludge as is currently done. We will continue to operate the facility to reduce the nitrogen discharge, maximize CSO flow capture and treatment as well as reduce Town costs.

Should you have any questions please contact me.

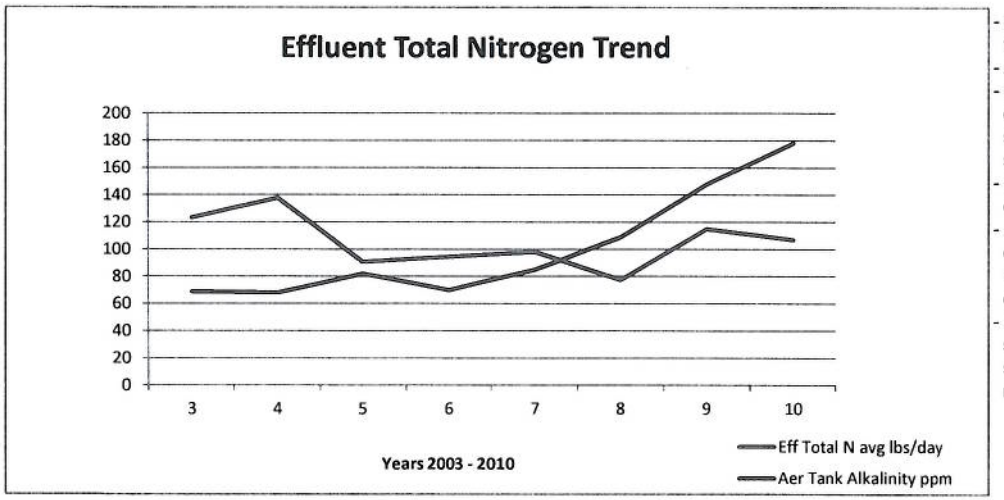
Respectfully,

Robert J. Trombley, Superintendent

pc: Town Administrator
Selectmen
WPCF Staff
DEP

NPDES Report 2009 Pg 15 Part 1H

Calendar Yr	N Total Lbs Avg Daily Effluent	Percent Change Effluent N	Alkalinity Aeration Tank ppm	Sludge Age = MCRT Secondary Days	Dissolved Oxygen Aeration Tank ppm	Food/Mass Ratio Secondary Treatment	Sludge Volume Index
2003	123		69	5.9	2.9	0.33	144
2004	138	12%	68	7.1	1.7	0.36	140
2005	91	-34%	82	7.4	1.3	0.3	130
2006	95	4%	70	7.8	1.4	0.33	135
2007	98	4%	85	8.4	1.3	0.44	161
2008	78	-21%	109	7	0.85	0.3	143
2009	115	48%	148	10.4	0.5	0.13	188
2010	107	-7%	178	21	0.29	0.2	161
Avg.	105		101	9.4	1.3	0.30	150
Min.	78		68	5.9	0.3	0.13	130
Max.	138		178	21.0	2.9	0.44	188



- N Total Lbs = pounds of total nitrogen discharged in the plant effluent to the Connecticut River.
- Alkalinity = Aeration tank mixed liquor alkalinity.
- Sludge Age = MCRT = time spent by a given weight of sludge in the secondary treatment system. Total secondary system lbs/pounds removed from the system daily.
- Dissolved Oxygen = average of the aeration tanks (2) dissolved oxygen concentration.
- Food/Mass Ratio = pounds primary biochemical oxygen demand/pounds of solids in the aeration tanks. Relates the available food mass to available solids or organisms that consume the food mass.
- Sludge Volume Index = a factor used to indicated the settleability of the sludge in the secondary treatment system. Low values represent better settleability but not necessarily better treatment.

Notes:
- **2008**, 22 July changed from plug flow to step feed.
- Began to move towards extended air process control.
- **2009**, 12 March, began to calculate wasting based on an 8 day sludge age.
- 1 June began to calculate wasting based on a 9 day sludge age.
- 30 July, began to calculate wasting based on an 11 day sludge age.
- **2010**, 23 March, Sludge age increase to 13 days.
- 12 May, sludge age increased to 15 days.
- 3 July, sludge age increased to 17 days.
- 30 December, sludge age increased to 20 days.

EFFLUENT NITROGEN ANALYSIS FOR CALENDAR YEAR 2011

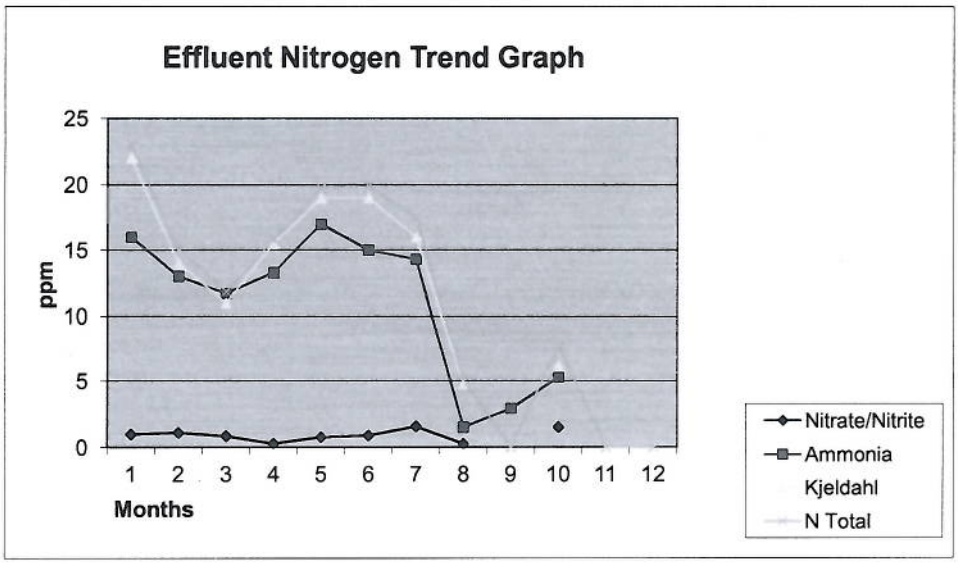
Total nitrogen = Nitrate/Nitrite + Kjeldahl

2011	Nitrate/Nitrite	Ammonia	Kjeldahl	N Total
Jan avg of 2	0.98	16	22	22.98
Feb avg of 2	1.1	13	14	15.10
Mar. avg of 2	0.85	12	11	11.85
Apr. avg of 2	0.30	13.3	15.5	15.80
May avg of 2	0.78	17	19	19.78
June avg of 2	0.89	15	19	19.89
July avg of 5	1.56	14.3	16	17.56
Aug.	0.27	1.5	4.8	5.07
Sep.		2.9		0.00
Oct.	1.5	5.3	6.2	7.70
Nov.				0.00
Dec.				0.00
Avg.	0.9	11.0	14.2	11.3
Max.	1.56	17	22	22.98
Min.	0.27	1.5	4.8	0

Conversion lbs/day/mg/ppm 8.34

Avg. Total Nitrogen concentration 11.3
Avg. WPCF daily flow 0.840 Monthly Average.
Avg. daily pounds discharged 79

Percentage Change from previous year.
2010 107
2011 79 -26%
lbs.



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U.S. Environmental Protection Agency
Water Enforcement, OES4-5MR
5 Post Office Square, Suite 100
Boston, MA 02109-3912

2 March 2011

MAR - 1 2011

RE: NPDES MA0100137, Annual Nitrogen Report, 2010

To whom it may concern:
In accordance with the NPDES Permit Part 1 H. Special Conditions the following information concerning nitrogen removal at the WPCF is provided.

The NPDES permit notes that "the annual average nitrogen load from this facility to the Connecticut River (2004-2005) is estimated to be 172 lbs/day."

History prior to 2010

2008

Efforts to reduce the discharge of Total Nitrogen into the Connecticut River began in 2008:

- Aeration tank flow changed from plug to stepped feed, 22 July 2008.
- Alkalinity changed from 2007 average = 85 ppm to 2008 = 109 ppm.

2009

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Should you have any questions please contact me.

Respectfully,

Robert J. Trombley

Robert J. Trombley, Superintendent

pc: Town Administrator
Selectmen
WPCF Staff
DEP

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NPDES Report 2009 Pg 15 Part 1H

Calendar Yr	N Total Lbs Avg Daily Effluent	Percent Change Effluent N	Alkalinity Aeration Tank ppm	Sludge Age = MCRT Secondary Days	Dissolved Oxygen Aeration Tank ppm	Food/Mass Ratio Secondary Treatment	Sludge Volume Index
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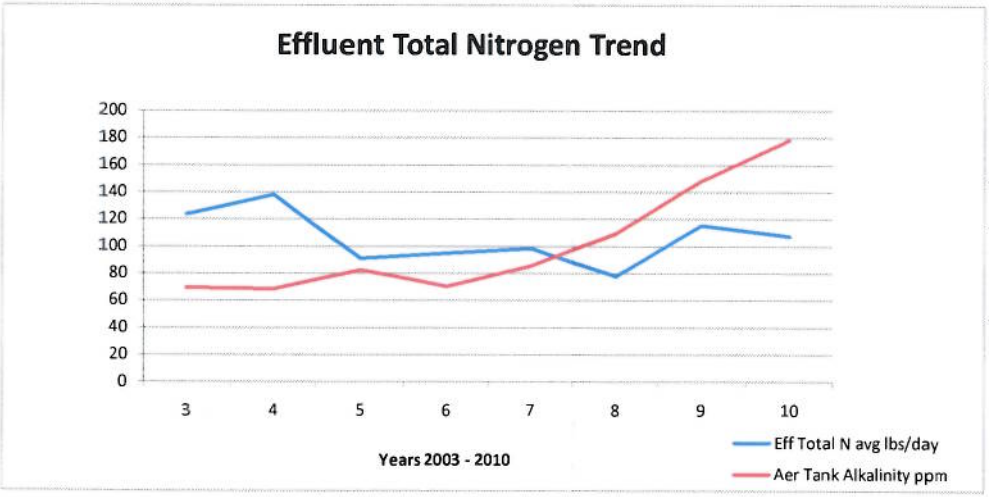

- N Total Lbs = pounds of total nitrogen discharged in the plant effluent to the Connecticut River.
- Alkalinity = Aeration tank mixed liquor alkalinity.
- Sludge Age = MCRT = time spent by a given weight of sludge in the secondary treatment system. Total secondary system lbs/pounds removed from the system daily.
- Dissolved Oxygen = average of the aeration tanks (2) dissolved oxygen concentration.
- Food/Mass Ratio = pounds primary biochemical oxygen demand/pounds of solids in the aeration tanks. Relates the available food mass to available solids or organisms that consume the food mass.
- Sludge Volume Index = a factor used to indicated the settleability of the sludge in the secondary treatment system. Low values represent better settleability but not necessarily better treatment.

Notes:
- **2008**, 22 July changed from plug flow to step feed.
- Began to move towards extended air process control.
- **2009**, 12 March, began to calculate wasting based on an 8 day sludge age.
- 1 June began to calculate wasting based on a 9 day sludge age.
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- **2010**, 23 March, Sludge age increase to 13 days.
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- 30 December, sludge age increased to 20 days.

EFFLUENT NITROGEN ANALYSIS FOR CALENDAR YEAR 2010

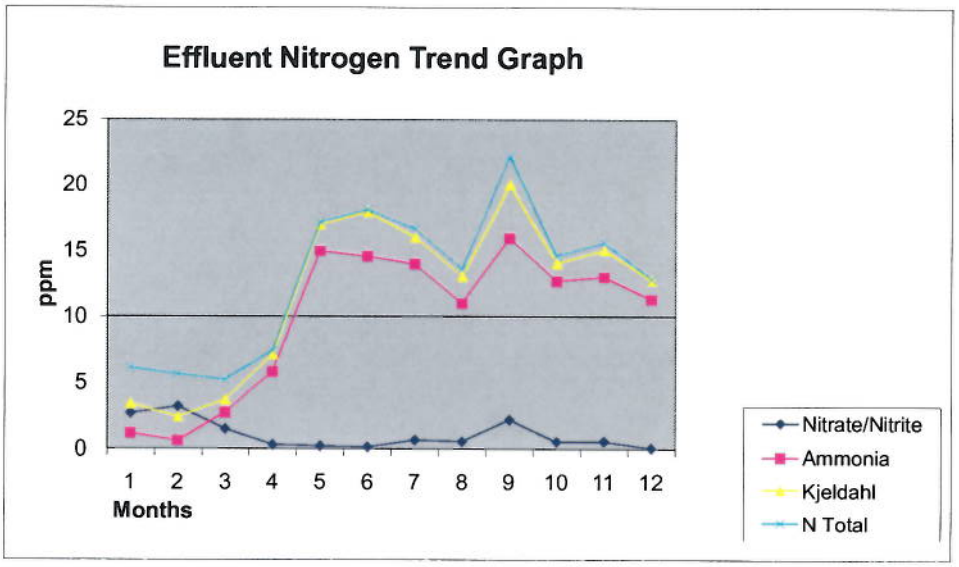
Total nitrogen = Nitrate/Nitrite + Kjeldahl

Date 2010	Nitrate/Nitrite	Ammonia	Kjeldahl	N Total
Jan	2.7	1.2	3.4	6.1
Feb. avg of 2	3.2	0.64	2.4	5.6
Mar. avg of 2	1.49	2.76	3.7	5.2
Apr. avg of 2	0.32	5.8	7.1	7.4
May avg of 2	0.23	15	17	17.2
June avg of 2	0.16	14.6	18	18.2
July avg of 2	0.68	14	16	16.7
Aug avg of 2	0.57	11	13	13.6
Sep avg of 2	2.2	16	20	22.2
Oct	0.56	12.7	14	14.6
Nov	0.58	13	15	15.6
Dec avg of 2	0.096	11.3	12.7	12.8
Avg.	1.1	9.8	11.9	12.9
Max.	3.2	16	20	22.2
Min.	0.096	0.64	2.4	5.19

Conversion lbs/day/mg/ppm 8.34

Avg. Total Nitrogen concentration 12.9
Avg. WPCF daily flow 0.997 Rolling average
Avg. daily pounds discharged 107

Percentage Change from previous year.
2009 115
2010 107 -7%
lbs.



INFLUENT NITROGEN ANALYSIS FOR CALENDAR YEAR 2010

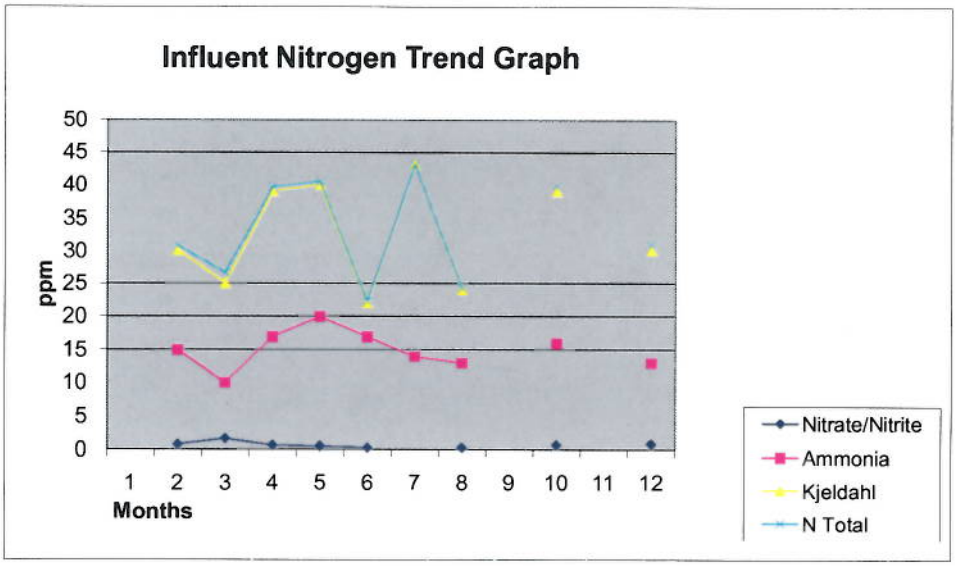
Total nitrogen = Nitrate/Nitrite + Kjeldahl

Date 2010	Nitrate/Nitrite	Ammonia	Kjeldahl	N Total
Jan.				
Feb.	0.74	15	30	30.7
Mar.	1.6	10	25	26.6
Apr.	0.63	17	39	39.6
May	0.48	20	40	40.5
June	0.26	17	22	22.3
July		14	43	43.0
Aug.	0.27	13	24	24.3
Sep.				
Oct.	0.68	16	39	39.7
Nov.				
Dec.	0.86	13	30	30.9
Avg.	0.7	15.0	32.4	33.1
Max.	1.6	20	43	43
Min.	0.26	10	22	22.26

Conversion lbs/day/mg/ppm 8.34

Avg. Total Nitrogen concentration 33.1
Avg. WPCF daily flow 0.997 Rolling average
Avg. daily pounds influent/raw 275

Percentage Change from previous year.
2009 0
2010 275 #DIV/0!
lbs.



Town of Montague

Water Pollution Control Facility
34 Greenfield Road
Montague MA 01351-9522
WPCFSUPT@MONTAGUE.NET

(413) 773-8865
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U.S. Environmental Protection Agency
Water Enforcement, OES4-SMR
5 Post Office Square, Suite 100
Boston, MA 02109-3912

17 April 2014

APR 1 7 2014

RE: NPDES MA0100137, Annual Nitrogen Report, 2013

To whom it may concern:
In accordance with the NPDES Permit Part 1 H. Special Conditions the following information concerning nitrogen removal at the WPCF is provided.

The NPDES permit notes that "the annual average nitrogen load from this facility to the Connecticut River (2004-2005) is estimated to be 172 lbs/day."

History prior to 2013

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The average annual daily discharge to the Connecticut River = 60 pounds. This represents a 45% reduction from calendar year 2011.

- The changes in process made in 2011 were carried through into 2012.
- Valves operation was all done manually, labor intensive, until automated in August.
- 27 June, oxidation reduction potential (ORP) metering came on line with integration to the supervisory control and data acquisition system (SCADA).
- 13 August, installation of motorized valve actuators for the AT RAS and air valves; the system was integrated with SCADA.
- SCADA 4 modes of operation were programmed allowing operations staff to respond to varying process conditions while also providing the tools to continue experimentation to make the nutrient removal process more efficient.

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The average annual daily discharge to the Connecticut River = 76 pounds. This represents a 28% increase from calendar year 2012.

2 modifications:

- The first was the automation of the AT drain valves. We believe this may further advance nutrient reduction by allowing the option to drain mixed liquor suspended solids (MLSS) back to the primary effluent pump wet well where they will mix sooner with primary effluent.
- The second is the direct addition of RAS to the headworks to mix with raw sewage after the aerated grit chamber. We have observed two changes as the result of this, the first being a reduction of odors and significant bubbling or denitrification occurring in the primary clarifiers. During expected periods of wet weather the RAS to the headworks is discontinued until the event is over.

The automated valve operators were designed, fabricated and installed by facility staff. SCADA programming was done by Ames Electrical Consulting of Deerfield, MA.

One item that has made all the above very challenging is the variability of facility loadings. Though the number of residents served in Town is estimated to be about 7,400 we also have 3 significant industrial users. Their variability in production cycles and loadings associated do

not match typical residential diurnal loadings and so makes it difficult to nail down consistently lower effluent nutrient concentrations, and so we continue our efforts. Also beginning in June 2013 we began receiving and processing thickened sludge from other WWTP's in Franklin County.

During 2013, specifically for the period of June through December we increased the frequency of nutrient testing from 1 per month per the NPDES permit to weekly; a spreadsheet with the testing data results is included with this report. Though this is more costly as the samples are analyzed by a contract lab, Test America, we felt it necessary to obtain a larger number of samples to enable us to better evaluate the results of our efforts. We continue to work with Grant Weaver, The Water Planet Company, in the monitoring and adjusting of the process. We have been discussing the installation of more in-process monitoring instruments that could provide immediate real time indication of the changes we make in an effort to optimize nutrient removal. The instrumentation signals would be tied into the SCADA system for monitoring and to provide control to valves as desired for automatic control. Though this will not be inexpensive it would still be far less than a $4,000,000 estimated project cost as indicated in the Combined Sewer Overflow and Facilities Plan completed in 2005. A spreadsheet with the testing data results is included with this report.

Should you have any questions please contact me.

Respectfully,

Robert J. Trombley

Robert J. Trombley, Superintendent

pc: Town Administrator
Selectmen
WPCF Staff
DEP – Western Region

The Town of Montague is an Equal Opportunity Provider and Employer

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Sampling Event #	Date	Flow (MGD)	Influent-Raw Sewage (mg/L)								Primary Effluent (mg/L)						Final Effluent (mg/L)							
			Total N	Kjeldahl	NH_3	org-N	NO_2-NO_3	BOD	TSS	PO_4	Total N	Kjeldahl	NH_3	org-N	NO_2-NO_3	PO_4	Total N	Kjeldahl	NH_3	org-N	NO_2-NO_3	BOD	TSS	PO4
June	5	0.943	46	46	16	30	0.3	253	820	8	260	260	11	249	0.1	34	4.5	3.3	1.2	2.1	1.2	10	5	0.7
	12	1.331	44	43	14	29	0.9	1170	451	57	140	140	12	128	0.1	22	3.0	2.9	1.5	1.4	0.1	17	1	0.2
	19	1.285	36	36	24	12	0.1	581	806	24	100	100	20	80	0.1	23	4.0	3.6	2.2	1.4	0.4	10	6	0.1
	26	1.046	270	270	26	244	0.1	748	820	33	460	460	31	429	0.1	14	4.7	3.7	1.7	2.0	1.0	13	4	0.3
July	2	1.260	29	29	10	19	0.1	647	828	6	280	280	6	274	0.1	43	2.2	2.0	0.6	1.4	0.2	13	24	0.5
	10	1.052	270	270	38	232	0.1	690	778	38	660	660	24	636	0.1	110	4.8	4.6	1.9	2.7	0.2	22	67	0.6
	17	0.958	140	140	14	126	0.1	760	1029	40	510	510	9	501	0.1	91	6.4	6.3	1.3	5.0	0.1	14	53	1.4
	24	0.995	53	53	14	39	0.2	698	1070	12	371	370	10	360	0.8	68	3.5	3.3	1.0	2.3	0.2	16	8	0.5
	31	0.784	810	810	44	766	0.1	1203	1635	110	530	530	8	522	0.4	92	4.4	4.3	0.4	3.9	0.1	14	35	1.2
August	6	0.839	47	47	18	29	0.1	304	708	10	471	470	8	462	0.7	74	3.5	3.3	1.9	1.4	0.2	8	5	0.4
	14	0.908	54	54	16	38	0.1	792	633	12	510	510	7	503	0.4	90	11.4	11.0	0.9	10.1	0.4	15	11	1.2
	21	0.621	89	89	34	55	0.1	745	257	36	730	730	8	722	0.2	84	7.4	7.3	1.7	5.6	0.1	13	9	2.1
	28	0.843	21	21	8	13	0.3	306	597	4	180	180	8	172	0.2	71	2.5	1.6	0.4	1.2	0.9	13	11	0.4
September	4	0.815	92	92	20	72	0.1	956	357	11	530	530	9	521	0.1	100	3.5	3.4	0.9	2.5	0.1	11	17	0.7
	11	0.916	100	100	19	81	0.1	650	1143	14	550	550	7	543	0.2	110	2.3	2.2	0.4	1.9	0.1	14	31	1.2
	18	0.895	76	76	37	39	0.1	868	145	19	520	520	10	510	0.3	78	3.2	3.1	1.3	1.8	0.1	19	21	0.5
	24	0.855	120	120	27	93	0.1	1207	2722	10	580	580	10	570	0.3	89	7.0	6.8	5.2	1.6	0.2	39	14	0.9
October	2	0.670	25	25	13	12	0.1	640	2484	4	660	660	16	644	0.3	91	14.4	14.0	11.0	3.0	0.4	27	31	1.9
	9	0.785	47	47	10	37	0.1	469	1251	29	630	630	8	622	0.3	89	6.0	5.8	1.5	4.3	0.2	25	23	1.1
	16	0.781	54	54	35	19	0.1	517	4550	8	690	690	9	681	0.2	100	4.5	4.3	0.7	3.6	0.2	29	26	0.9
	23	0.960	0					1569	7182		310	310	10	300	0.1	110	4.4	4.3	1.5	2.8	0.1	21	46	1.1
	29	0.820	55	53	10	43	1.6	589	1013	16	350	350	5	345	0.2	85	6.3	6.1	1.7	4.4	0.2	34	28	0.7
November	6	0.869	130	130	16	114	0.1	1170	1118	38	440	440	42	398	0.2	94	16.2	16.0	0.8	15.2	0.2	42	28	1.8
	13	0.930	46	46	19	27	0.2	552	1210	7	340	340	7	333	0.1	50	5.8	5.7	1.2	4.5	0.1	21	17	0.7
	20	0.916	150	150	20	130	0.4	1848	705	16	630	630	9	621	0.4	81	13.1	13.0	0.2	12.8	0.1	28	36	2.1
	26	1.216	120	120	23	97	0.3	1871	2102	4	630	630	13	617	0.1	78	36.2	36.0	6.6	29.4	0.2	26	72	3.6
December	4	0.889	77	76	27	49	0.6	1406	445	12	350	350	15	335	0.1	56	15.4	15.0	13.0	2.0	0.4	29	20	0.7
	11	0.931	72	72	18	54	0.3	1890	1695	12	430	430	12	418	0.1	45	7.3	6.7	6.2	0.5	0.6	32	35	0.3
	18	0.930	66	66	13	53	0.3	1756	1111	10							7.7	7.6	6.2	1.4	0.1	21	43	0.6
	23	0.984	0					476	705		360	360	10	350	0.1	39	5.2	4.7	4.1	0.6	0.5	9	14	0.2
Average		0.934	105	112	21	91	0.2	911	1346	21	455	455	12	443	0.2	73	7.4	7.1	2.6	4.4	0.3	20	25	0.96
Median		**0.916**	**60**	**69**	**19**	**46**	**0.1**	**747**	**921**	**12**	**471**	**470**	**10**	462	0.2	81	5.0	4.7	1.5	2.4	0.2	18	22	0.72
Minimum		0.621	0	21	8	12	0.1	253	145	4	100	100	5	80	0.1	14	2.2	1.6	0.2	0.5	0.1	8	1	0.12
Maximum		1.331	810	810	44	766	1.6	1890	7182	110	730	730	42	722	0.8	110	36.2	36.0	13.0	29.4	1.2	42	72	3.6

4/14/2014

8:32 AM

Calendar Year 2014

11:05 AM

CSO regulators weir elevation as of 2007:

7th & L St.	222.01 feet
Avenue A	181.10 ft.
Greenfield Rd.	143 ft.

Annual Event #	Date 2014	Flow control conditions: Ave. A bufr line outlet % open	Flow control conditions: Gfld Rd. Reg. valve % open	Precipitation Conditions: 24 hr clock - rain began	Precipitation Conditions: 24 hr clock - rain ended	Precipitation Conditions: Rain - in. WPCF	Precipitation Conditions: Rain - in. ADS	Regulator Overflow - gal. 7th & L	Regulator Overflow - gal. Ave. A	Regulator Overflow - gal. Gfld Rd.	Sec. Q SP mgd	Total Q mgd Inf. Pri.	Total Q mgd Sec. Eff.	Peak Q mgd Inf. Pri.	Peak Q mgd Sec. Eff.	Bypass gal. mgd
1	6-Jan	100	50	10:02	15:02	0.8	1.08	0	0	2,719	3	1.49	1.36	2.65	3.37	0.000
2	12-Jan	100	50	0:11	2:27	0.81	0.82	0	0	939	3	1.16	1.01	1.72	1.87	0.000
3	21-Feb	100	50	0:00	0:00	0.40	0.42	0	0	0	2.2	1.16	1.07	1.30	2.94	0.130
4	12-Mar	100	50	15:46	23:47	0.58	0.52	0	0	17,326	2.2/1.7	1.69	0.75	2.98	2.25	0.346
5	20-Mar	100	50	0:00	15:43	0.71	0.70	0	0	1,429	3.0	1.82	1.34	3.57	3.00	0.000
6	29-Mar	100	50	17:10	0:00	1.74	1.67	0	0	44,804	2.2	2.00	1.15	3.13	1.30	0.259
7	30-Mar	100	50	0:00	0:00	0.76	0.49	0	0	2,072	3.0/2.0	1.85	1.55	3.17	2.35	0.604
					Total flow			-	-	69,289						

The secondary treatment plant flow design set point = 4 mgd. When the primary influent flow > the set point for > 5 minutes the wet weather system auto operation begins. The secondary treatment set point is adjustable.

Legend:

bufr = buffer, Gfld = Greenfield, Reg. = regulator, in. = inches, gal. = gallons, Sec. = secondary treatment, SP = setpoint, Inf. = influent, Pri. = primary treatment

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20 March 2015

MAR 19 2015

RE: NPDES MA0100137, Annual Nitrogen Report, 2014

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2014

The average annual daily discharge to the Connecticut River = 109 pounds. This represents a 43% increase from calendar year 2013 but is still less than the 2004-2005 estimate of 172 pounds per day, 37 % reduction. During calendar year 2014 we made three piping changes concerning the handling of sludge, they are as follows:

- Added a pipe to the gravity thickener drain line to permit the draining of the aeration tanks (2), secondary clarifiers (2) and the chlorine contact tank (2) to the head of the primary clarifiers.
- Added a pipe and valve to the return activated sludge (RAS) pump discharge manifold to allow the pumping of RAS directly to the headworks.
- Added a pipe to the thickened sludge pump discharge manifold to allow the pumping of RAS directly to the headworks.

This modification noted provides the option to feed the various flows to a point earlier in the process to begin the biological reduction of raw sewage components. These changes also allow us to recycle and thereby feed the system with sludges that become a food source for the plant process organisms. This is part of our sludge reduction efforts that to date have been very successful.

The variability of facility loadings makes process control very challenging. Though the number of residents served in Town is estimated to be about 7,400 we also have 3 significant industrial users. Their variability in production cycles and loadings associated do not match typical residential diurnal loadings and so makes it difficult to nail down consistently lower effluent nutrient concentrations, and so we continue our efforts. Also beginning in June 2013 we began receiving and processing thickened sludge from other WWTP's in Franklin County. We utilize septage and the outside sources of sludge to feed the sludge reduction process, attempting to level load the plant.

We continue to work with Grant Weaver, The Water Planet Company, in the monitoring, adjusting of the process and developing process control guidelines. We continue to discuss the installation of more in-process monitoring instruments that could provide immediate real time indication of the changes we make in an effort to optimize nutrient removal. The instrumentation signals would be tied into the SCADA system for monitoring and to provide control to valves as desired for automatic control. Though this will not be inexpensive it would still be far less than a $4,000,000 estimated project cost as indicated in the Combined Sewer Overflow and Facilities Plan completed in 2005. A spreadsheet with the effluent testing data for 2014 is included with this report.

Should you have any questions please contact me.

Respectfully,

Robert J. Trombley

Robert J. Trombley, Superintendent

pc: Town Administrator
Selectmen/Sewer Commission
WPCF Staff
File – EPA reports
DEP – Western Region

EFFLUENT NITROGEN ANALYSIS FOR CALENDAR YEAR 2014

Total nitrogen = Nitrate/Nitrite + Kjeldahl

					WPCF	
2014	Nitrate/Nitrite	Ammonia	Kjeldahl	N Total	Q	N Tot. lbs
Jan	0.4	4.10	11.0	11.4	0.9	86
Feb	0.4	11.00	15.0	15.4	0.8	105
Mar	0.1	12.00	18.0	18	0.833	125
Apr	0.1	8.40	25.0	25	1.095	229
May	0.6	9.60	21.0	22	0.831	150
June	2.1	16.00	36.0	38	0.81	257
July	1.2	7.00	9.1	10	0.829	71
Aug.	0.1	4.30	6.3	6	0.779	41
Sep.	0.8	3.70	5.7	7	0.737	40
Oct	0.2	6.5	12	12	0.761	78
Nov	0.4	8.4	10	10	0.796	69
Dec	0.9	6.0	5	6.3	1.106	58
Avg.	0.6	8.1	14.5	15.1	0.9	109.2
Max.	2.1	16.0	36.0	38.1		257.4
Min.	0.1	3.7	5.4	6.3		40.0

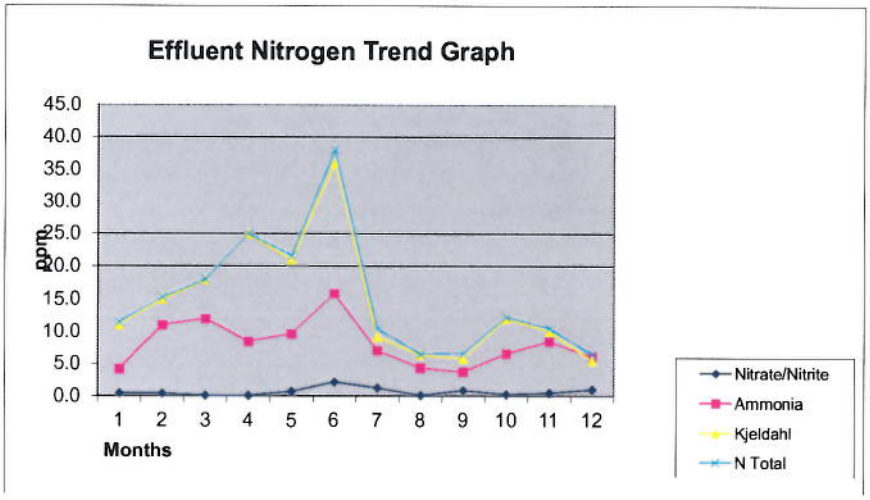
Conversion lbs/day/mg/ppm 8.34

Avg. Total Nitrogen concentration 15.1
Avg. WPCF daily flow 0.858 Monthly A
Avg. daily pounds discharged 108

Conversion lbs/day/mg/ppm 8.34

Percentage Change from previous year.

2013	76	
2014	109	43%
	lbs.	



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Environmental Protection Agency
Water Technical Unit (SEW)
P.O. Box 8127
Boston, MA 02114

6 November 2009

RE: NPDES Permit MA0100137, Effluent Nitrogen Reduction

To whom it may concern:
Enclosed is the report as required by the NPDES Permit, Part 1.H, Special Conditions.

"Within **one year of the effective date of the permit,** the permittee shall complete an evaluation of alternative methods of operating the existing wastewater treatment facility to optimize the removal of nitrogen, and submit a report to the EPA and Mass DEP documenting this evaluation and presenting a description of recommended operational changes. The methods to be evaluated include, but are not limited to, operational changes to enhance nitrification (seasonal and year round), incorporation of anoxic zones, septage receiving policies and procedures, and side stream management. The permittee shall implement the recommended operational changes in order to maintain the existing mass discharge loading of total nitrogen. The annual average total nitrogen load from this facility (2004 – 2005) is estimated to be 172 pounds/day."

The following report is divided into sections addressing the individual tasks noted in the report requirements listed above.

I. "Within **one year of the effective date of the permit,** the permittee shall complete an evaluation of alternative methods of operating the existing wastewater treatment facility to optimize the removal of nitrogen, and submit a report to the EPA and Mass DEP documenting this evaluation and presenting a description of recommended operational changes. The methods to be evaluated include, but are not limited to, operational changes to enhance nitrification (seasonal and year round), incorporation of anoxic zones, septage receiving policies and procedures, and side stream management."

An evaluation of alternative methods of operating the existing wastewater treatment facility to optimize the removal of nitrogen was completed as part of the Preliminary Engineering Report dated 2006 by Camp Dresser & McKee (CDM). Excerpts addressing nitrogen removal from that report are contained herein. In summary the report notes that a process known as the Modified Ludzack-Ettinger process would be a cost-effective process for the reduction of nitrogen discharged to the Connecticut River from the WPCF. The process provides for increased aeration capacity, added tank volume of 700,000 gallons; existing aeration tank volume is 460,000 gallons. This would include new pumps piping and submersible mixers associated with the expanded volume. The estimated cost, 2006, was $4,500,000. This report was previously submitted to both the EPA and DEP as part of the

workup towards the Combined Sewer Overflow and WPCF Upgrade project. As part of the septage receiving policies and procedures a new septage receiving addition to the existing septage tank was proposed. The system involved a screening and degritting device that would have removed debris prior to pumping into the facility. Due to increased costs this improvement was eliminated from the project. It was envisioned that the processed septage would be sent directly to the sludge holding tanks and processed through the proposed upgrade to the biosolids handling system. In this way the septage load to the secondary treatment process would be greatly reduced. It was expected that the amount of nitrogen compounds sent through the entire facility would be less than at present. Policies to reflect the change due the deletion of the septage upgrade from the project have therefore not been addressed; the current practice of septage handling will be continued. That practice involves the metered pumping of septage into the facility overnight and holding septage until the weekend to help level load the WPCF when certain industries shutdown. Side stream management involves:

- Operations Building floor drainage back to the headworks, minimal.
- Sludge holding tank decanting back to the headworks, minimal.
- Wasting biosolids from the secondary treatment system to the influent to the primary treatment system. This is a standard practice that may be modified when the solids handling upgrade is on line. Modification would be to send the waste activated sludge directly to the gravity thickener vs. mixing with primary sludge then being pumped from the primary clarifiers to the gravity thickener.
- Overflow of the gravity thickener to the secondary treatment system. This may be modified when the solids handling upgrade is on line by reducing/eliminating any gravity thickener overflow to the secondary system.

II. The permittee shall implement the recommended operational changes in order to maintain the existing mass discharge loading of total nitrogen. The annual average total nitrogen load from this facility (2004 – 2005) is estimated to be 172 pounds/day."

Operational changes to reduce the quantity of nitrogen compounds discharge in the facility effluent to the Connecticut River were instituted in July of 2008. In summary the changes made since July 2008 resulted in the reduction of total nitrogen load from the facility of 53%. This is based on the estimated 2004 – 2005 172 pounds/day compared to the 2009 (January through September) estimated 81 pounds/day.

- 22 July 2008 – Change from aeration flow pattern from tank plug flow to stepped feed. Associated with this change the air feed to the end of the aeration tank was reduced. Alkalinity in the aeration tank change from an average of 85 parts per million (ppm) 2007 average to 109 ppm 2008 average. The alkalinity average for 2009 through September was 137 ppm.

- 2009 – We began to move the secondary treatment process from conventional waste activated towards extended aeration process control.
  12 March, began calculating wasting based on an 8 day sludge age.
  1 June, began calculating wasting based on a 9 day sludge age.
  30 July, Began to calculate wasting on an 11 day sludge age. The aeration tank dissolved oxygen control system setpoint was changed from 1 ppm to .4 ppm.

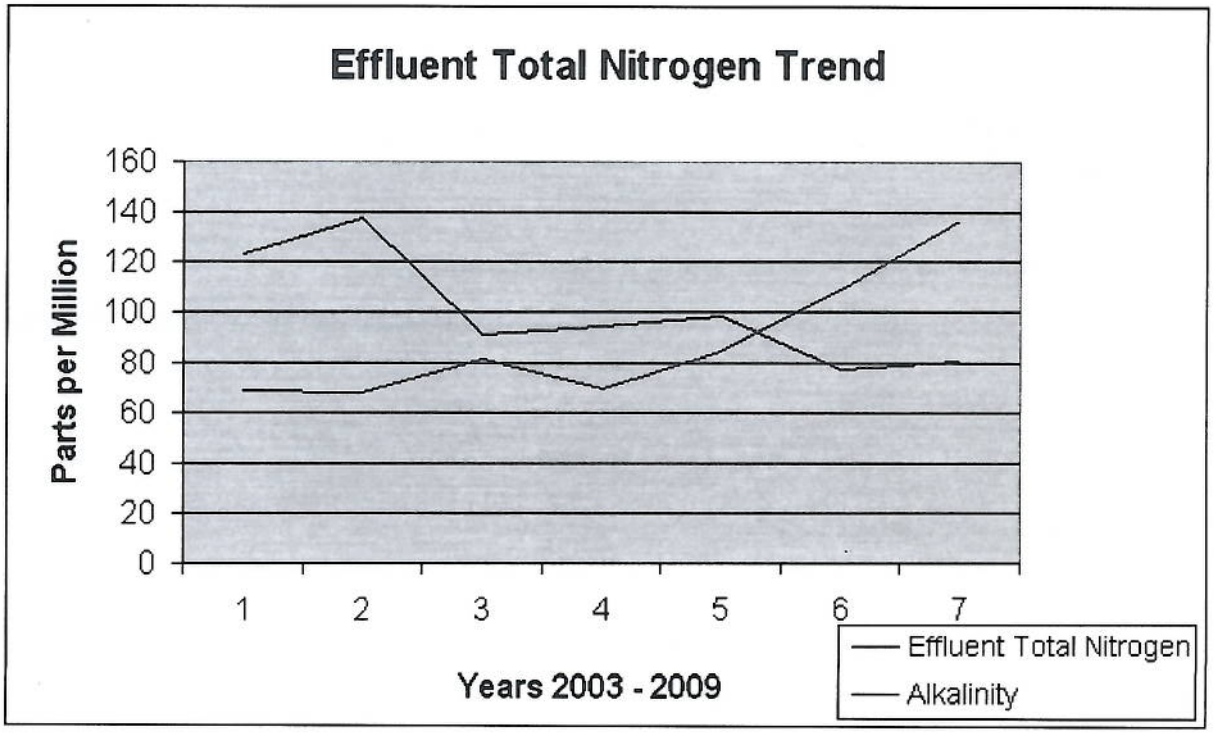
These changes have resulted in a 53% reduction in the pounds of total nitrogen discharged to the Connecticut River. Trend charts are attached that demonstrate the changes over time

for various process parameters. We intend to continue to reduce the amount of total nitrogen discharge from the facility. The extended aeration process has not been operated through a cold weather season, the coming winter will provide the opportunity to test system nitrogen removal.

I have included below data representing the trends in nitrogen discharge and process control from 2003 through September 2009.

NPDES Report 2009 Pg 15 Part 1H

Calendar Yr	N Total Lbs	Alkalinity
	Average	Aeration Tank
	ppm	ppm
2003	123	69
2004	138	68
2005	91	82
2006	95	70
2007	98	85
2008	78	109
2009	81	137
Avg.	100	89
Min.	78	68
Max.	138	137



Notes:
- 22 July 2008 changed from plug flow to step feed.
- Began to move towards extended air process control:
  - 12 March 2009 began to calculate wasting based on an 8 day sludge age.
  - 1 June 2009 began to calculate wasting based on a 9 day sludge age.
  - 30 July 2009 began to calculate wasting based on an 11 day sludge age.

Calendar year 2009 reflects data through September.

Calendar Year	Sludge Age Secondary Days	Dissolved Oxygen Aeration Tank ppm	Food/Mass Ratio Secondary Treatment	Sludge Volume Index
2003	5.9	2.9	0.33	144
2004	7.1	1.7	0.36	140
2005	7.4	1.3	0.3	130
2006	7.8	1.4	0.33	135
2007	8.4	1.3	0.44	161
2008	7	0.85	0.3	143
2009	10.4	0.5	0.13	188

Should you have any questions please contact me.

Respectfully,

Robert J. Trombley, Superintendent

pc: Selectboard
Town Administrator
WPCF Staff
Mass DEP

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C:\Documents and Settings\Administrator\My Documents\Process Control\Nutrients\Nitrogen\Nitrogen reduction NPDES report Nov 2009.doc

Town of Montague

Water Pollution Control Facility
34 Greenfield Road
Montague MA 01351-9522
WPCFSUPT@MONTAGUE.NET

(413) 773-8865
FAX: (413) 774-6231

Water Technical Unit
U.S. Environmental Protection Agency
P.O. Box 8127
Boston, MA 02114

20 March 2009

RE: NPDES MA0100137

To whom it may concern:
In accordance with the NPDES Permit Part 1 H. Special Conditions the following information concerning nitrogen removal at the WPCF is provided.

Efforts to reduce the discharge of Total Nitrogen into the Connecticut River began in July of 2008. During the month of July the secondary treatment process was changed. The aeration system for many years had been operated in a plug flow configuration, this was changed to step feed. The air to the diffusers in the aeration tank was throttled down at the end of the tank with the intent to push the system towards denitrification just prior to overflowing from the aeration basins to the secondary clarifiers. When comparing calendar year 2007 results to 2008 results there is a slight decrease in the average concentration for all species of nitrogen tracked. The attached data sheet and graphs bear this out. The overall reduction of total nitrogen (nitrate/nitrite + Kjeldahl nitrogen) calculates out to be a 21% reduction. The NPDES permit notes that "the annual average nitrogen load from this facility (2004-2005) is estimated to be 172 lbs/day." The 2008 estimate is 77 pounds per day. We are continuing to experiment with process changes in an effort to further reduce the nitrogen load to the river.

Should you have any questions please contact me.

Respectfully,

Robert J. Trombley, Superintendent

pc: Town Administrator
Selectmen
WPCF Staff
DEP

The Town of Montague is an Equal Opportunity Provider and Employer

C:\Documents and Settings\Administrator\My Documents\Regulatory Agencies\State\DEP\Nitrogen\Nitrogen report 2008 annual 19 Mar 09.doc

Town of Montague

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Water Technical Unit
U.S. Environmental Protection Agency
P.O. Box 8127
Boston, MA 02114

12 February 2010

RE: NPDES MA0100137

To whom it may concern:
In accordance with the NPDES Permit Part 1 H. Special Conditions the following information concerning nitrogen removal at the WPCF is provided.

Efforts to reduce the discharge of Total Nitrogen into the Connecticut River began in July of 2008:

- Aeration tank flow changed from plug to stepped feed, 22 July 2008.
- Alkalinity changed from 2007 average = 85 ppm to 2008 = 109 ppm.

We continued to change the process control of the secondary treatment system in 2009:

- 12 March, sludge age wasting calculation based on 8 days.
- 1 June, sludge age wasting calculation based on 9 days.
- 30 July, sludge age wasting calculation based on 11 days. Aeration tank dissolved oxygen setpoint changed from 1 ppm to .4 ppm.
- 17 November, sludge age wasting calculation based on 12 days.
- 2 December, sludge age wasting calculation based on 15 days.

The NPDES permit notes that "the annual average nitrogen load from this facility (2004-2005) is estimated to be 172 lbs/day." There was an increase in the average total nitrogen pounds per day from 2008 to 2009 of 48 lbs (50% increase). When comparing the 2009 average total nitrogen pounds per day to the NPDES value there remains a reduction of 57 pounds (33% reduction). We are continuing to experiment with the extended air process in an effort to further reduce the nitrogen load to the river.

Should you have any questions please contact me.

Respectfully,

Robert J. Trombley, Superintendent

pc: Town Administrator
Selectmen
WPCF Staff
DEP

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U.S. Environmental Protection Agency
Water Enforcement, OES4-5MR
5 Post Office Square, Suite 100
Boston, MA 02109-3912

2 March 2011

RE: NPDES MA0100137, Annual Nitrogen Report, 2010

To whom it may concern:
In accordance with the NPDES Permit Part 1 H. Special Conditions the following information concerning nitrogen removal at the WPCF is provided.

The NPDES permit notes that "the annual average nitrogen load from this facility to the Connecticut River (2004-2005) is estimated to be 172 lbs/day."

History prior to 2010

2008
Efforts to reduce the discharge of Total Nitrogen into the Connecticut River began in 2008:

- Aeration tank flow changed from plug to stepped feed, 22 July 2008.
- Alkalinity changed from 2007 average = 85 ppm to 2008 = 109 ppm.

2009

- 12 March, sludge age wasting calculation based on 8 days.
- 1 June, sludge age wasting calculation based on 9 days.
- 30 July, sludge age wasting calculation based on 11 days. Aeration tank dissolved oxygen setpoint changed from 1 ppm to .4 ppm.
- 17 November, sludge age wasting calculation based on 12 days.
- 2 December, sludge age wasting calculation based on 15 days.

Report on reduction efforts 2010
The NPDES permit required testing frequency for effluent nitrogen levels is once per month. We have performed two per month except for October & November where one/month was done; also tested was the influent sewage as well, the data is enclosed with this report. The target sludge age has been gradually increased over time. This age increase has been done in an effort to meet extended air process control conditions of the secondary treatment system with the goal of reducing the pounds of biosolids to be disposed. We have had some success with this shown by the reduction in the dry tonnage of solids produced and the concurrent expenditure reduction. In fiscal year 2010 the estimated tonnage and budget figures were 695 tons at a cost of $355,000 but the actual were 410 tons for $206,723. There were some

industrial loading changes that also affected these figures. Concurrent with the impact of solids reduction is the effect on total nitrogen discharged, the average for 2010 while lower than 2009 is higher than we had hoped. In calendar year 2010 the sludge age again was adjusted:

- 23 March, increased to 13 days.
- 12 May, increased to 15 days.
- 3 July, increased to 17 days.
- 30 December increased to 20 days.

Sludge age changes have been made slowly over time to allow for the observation of process changes. There is also the concern that while the extended air process has provided the opportunity to realize savings for the Town there is also a level of risk involved. The risk level has to do with higher than normal secondary clarifier blankets due to the solids inventory in the secondary system as a result of the extended air process. When the higher blankets are present and you overlay the combined sewer overflow upgrades of recent years the prospect of solids washout due to increase WPCF flows exists during wet weather events. The process of monitoring and reacting to changes to safeguard the National Permit Discharge Elimination System limit requirements therefore is more complicated than it would otherwise be. We have recently, 2 February 2011, modified the aeration tank (AT) air distribution pattern. Inlet air has been shut off at the head of the AT and is now fed towards the end with the goal of further reducing the total pounds of nitrogen discharge to the Connecticut River. Be advised that as part of the CSO project a new dewatering system, Fournier rotary press will be installed and brought on line in June 2011. This will impact the process as the pressate from the dewatering process will be returned to the facility, this is in contrast to having it hauled away as a part of the thickened sludge as is currently done. We will continue to operate the facility to reduce the nitrogen discharge, maximize CSO flow capture and treatment as well as reduce Town costs.

Should you have any questions please contact me.

Respectfully,

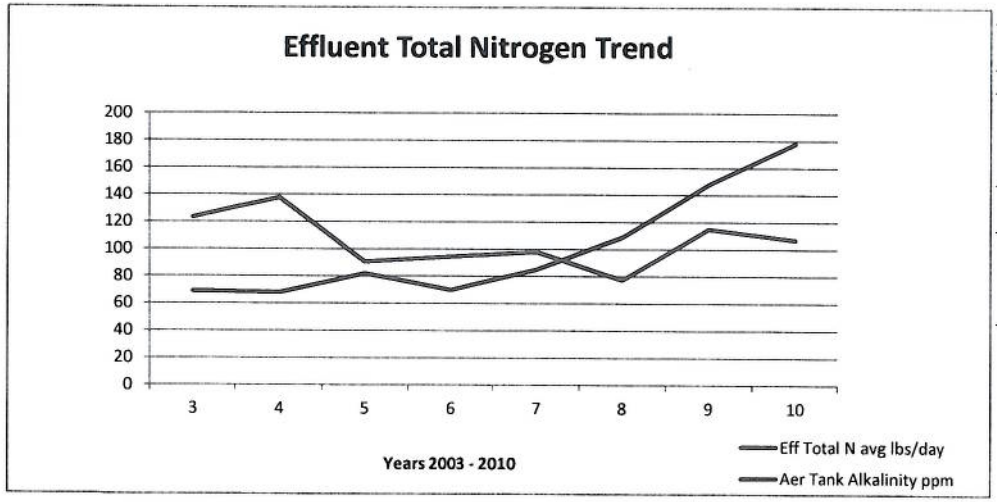
Robert J. Trombley, Superintendent

pc: Town Administrator
Selectmen
WPCF Staff
DEP

The Town of Montague is an Equal Opportunity Provider and Employer

NPDES Report 2009 Pg 15 Part 1H

Calendar Yr	N Total Lbs Avg Daily Effluent	Percent Change Effluent N	Alkalinity Aeration Tank ppm	Sludge Age = MCRT Secondary Days	Dissolved Oxygen Aeration Tank ppm	Food/Mass Ratio Secondary Treatment	Sludge Volume Index
2003	123		69	5.9	2.9	0.33	144
2004	138	12%	68	7.1	1.7	0.36	140
2005	91	-34%	82	7.4	1.3	0.3	130
2006	95	4%	70	7.8	1.4	0.33	135
2007	98	4%	85	8.4	1.3	0.44	161
2008	78	-21%	109	7	0.85	0.3	143
2009	115	48%	148	10.4	0.5	0.13	188
2010	107	-7%	178	21	0.29	0.2	161
Avg.	105		101	9.4	1.3	0.30	150
Min.	78		68	5.9	0.3	0.13	130
Max.	138		178	21.0	2.9	0.44	188



- N Total Lbs = pounds of total nitrogen discharged in the plant effluent to the Connecticut River.
- Alkalinity = Aeration tank mixed liquor alkalinity.
- Sludge Age = MCRT = time spent by a given weight of sludge in the secondary treatment system. Total secondary system lbs/pounds removed from the system daily.
- Dissolved Oxygen = average of the aeration tanks (2) dissolved oxygen concentration.
- Food/Mass Ratio = pounds primary biochemical oxygen demand/pounds of solids in the aeration tanks. Relates the available food mass to available solids or organisms that consume the food mass.
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Notes:
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- 30 December, sludge age increased to 20 days.

EFFLUENT NITROGEN ANALYSIS FOR CALENDAR YEAR 2011

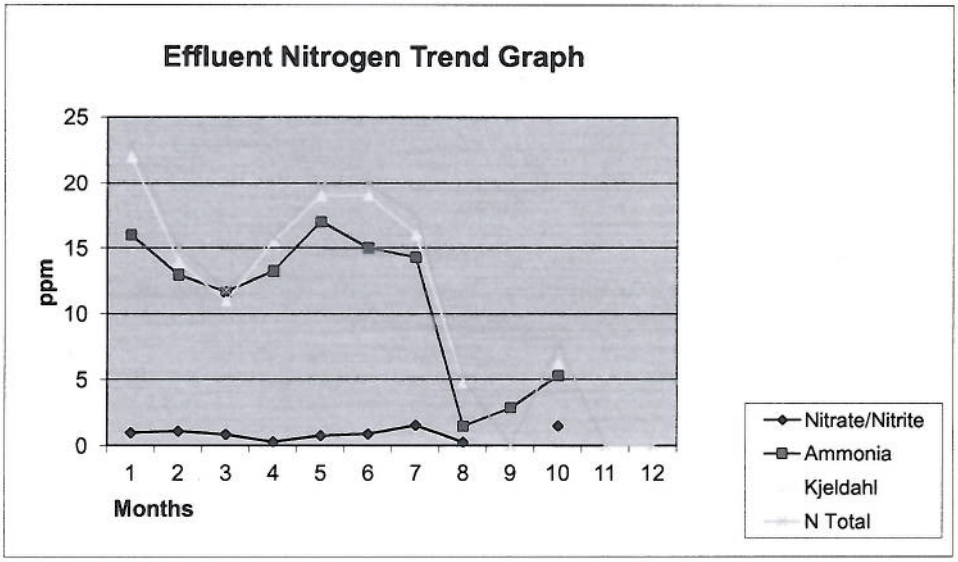
Total nitrogen = Nitrate/Nitrite + Kjeldahl

2011	Nitrate/Nitrite	Ammonia	Kjeldahl	N Total
Jan avg of 2	0.98	16	22	22.98
Feb avg of 2	1.1	13	14	15.10
Mar. avg of 2	0.85	12	11	11.85
Apr. avg of 2	0.30	13.3	15.5	15.80
May avg of 2	0.78	17	19	19.78
June avg of 2	0.89	15	19	19.89
July avg of 5	1.56	14.3	16	17.56
Aug.	0.27	1.5	4.8	5.07
Sep.		2.9		0.00
Oct.	1.5	5.3	6.2	7.70
Nov.				0.00
Dec.				0.00
Avg.	0.9	11.0	14.2	11.3
Max.	1.56	17	22	22.98
Min.	0.27	1.5	4.8	0

Conversion lbs/day/mg/ppm 8.34

Avg. Total Nitrogen concentration 11.3
Avg. WPCF daily flow 0.840 Monthly Average.
Avg. daily pounds discharged 79

Percentage Change from previous year.
2010 107
2011 79 -26%
lbs.



Town of Montague

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U.S. Environmental Protection Agency
Water Enforcement, OES4-5MR
5 Post Office Square, Suite 100
Boston, MA 02109-3912

2 March 2011

RE: NPDES MA0100137, Annual Nitrogen Report, 2010

To whom it may concern:
In accordance with the NPDES Permit Part 1 H. Special Conditions the following information concerning nitrogen removal at the WPCF is provided.

The NPDES permit notes that "the annual average nitrogen load from this facility to the Connecticut River (2004-2005) is estimated to be 172 lbs/day."

History prior to 2010

2008
Efforts to reduce the discharge of Total Nitrogen into the Connecticut River began in 2008:
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Should you have any questions please contact me.

Respectfully,

Robert J. Trombley

Robert J. Trombley, Superintendent

pc: Town Administrator
Selectmen
WPCF Staff
DEP

The Town of Montague is an Equal Opportunity Provider and Employer

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NPDES Report 2009 Pg 15 Part 1H

Calendar Yr	N Total Lbs Avg Daily Effluent	Percent Change Effluent N	Alkalinity Aeration Tank ppm	Sludge Age = MCRT Secondary Days	Dissolved Oxygen Aeration Tank ppm	Food/Mass Ratio Secondary Treatment	Sludge Volume Index
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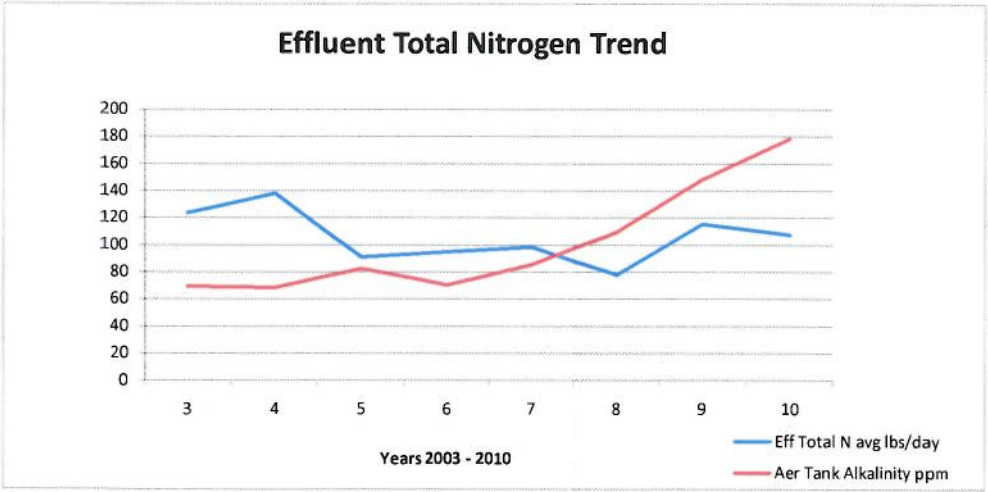
2006	95	4%	70	7.8	1.4	0.33	135
2007	98	4%	85	8.4	1.3	0.44	161
2008	78	-21%	109	7	0.85	0.3	143
2009	115	48%	148	10.4	0.5	0.13	188
2010	107	-7%	178	21	0.29	0.2	161
Avg.	105		101	9.4	1.3	0.30	150
Min.	78		68	5.9	0.3	0.13	130
Max.	138		178	21.0	2.9	0.44	188



- N Total Lbs = pounds of total nitrogen discharged in the plant effluent to the Connecticut River.
- Alkalinity = Aeration tank mixed liquor alkalinity.
- Sludge Age = MCRT = time spent by a given weight of sludge in the secondary treatment system. Total secondary system lbs/pounds removed from the system daily.
- Dissolved Oxygen = average of the aeration tanks (2) dissolved oxygen concentration.
- Food/Mass Ratio = pounds primary biochemical oxygen demand/pounds of solids in the aeration tanks. Relates the available food mass to available solids or organisms that consume the food mass.
- Sludge Volume Index = a factor used to indicated the settleability of the sludge in the secondary treatment system. Low values represent better settleability but not necessarily better treatment.

Notes:
- **2008**, 22 July changed from plug flow to step feed.
- Began to move towards extended air process control.
- **2009**, 12 March, began to calculate wasting based on an 8 day sludge age.
- 1 June began to calculate wasting based on a 9 day sludge age.
- 30 July, began to calculate wasting based on an 11 day sludge age.
- **2010**, 23 March, Sludge age increase to 13 days.
- 12 May, sludge age increased to 15 days.
- 3 July, sludge age increased to 17 days.
- 30 December, sludge age increased to 20 days.

EFFLUENT NITROGEN ANALYSIS FOR CALENDAR YEAR 2010

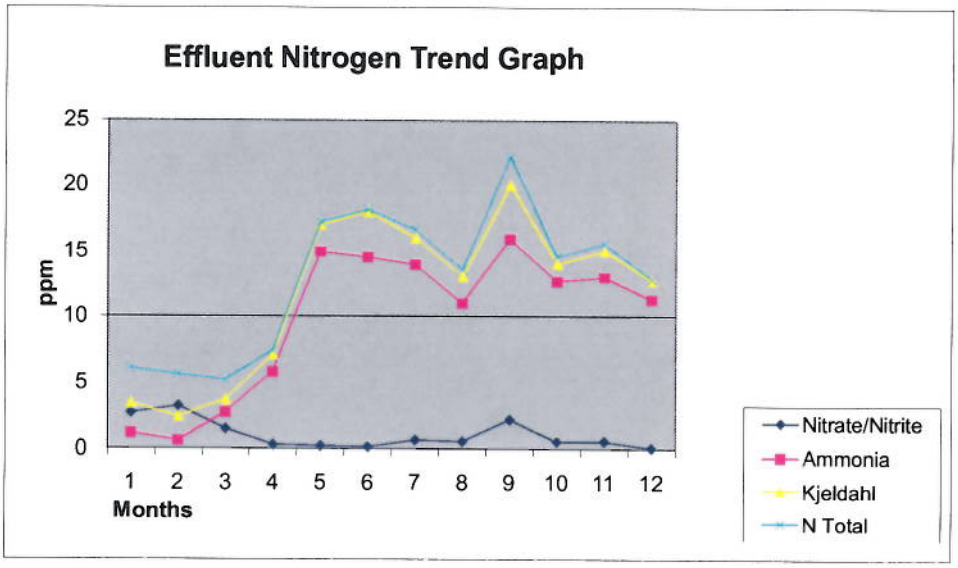
Total nitrogen = Nitrate/Nitrite + Kjeldahl

Date 2010	Nitrate/Nitrite	Ammonia	Kjeldahl	N Total
Jan	2.7	1.2	3.4	6.1
Feb. avg of 2	3.2	0.64	2.4	5.6
Mar. avg of 2	1.49	2.76	3.7	5.2
Apr. avg of 2	0.32	5.8	7.1	7.4
May avg of 2	0.23	15	17	17.2
June avg of 2	0.16	14.6	18	18.2
July avg of 2	0.68	14	16	16.7
Aug avg of 2	0.57	11	13	13.6
Sep avg of 2	2.2	16	20	22.2
Oct	0.56	12.7	14	14.6
Nov	0.58	13	15	15.6
Dec avg of 2	0.096	11.3	12.7	12.8
Avg.	1.1	9.8	11.9	12.9
Max.	3.2	16	20	22.2
Min.	0.096	0.64	2.4	5.19

Conversion lbs/day/mg/ppm 8.34

Avg. Total Nitrogen concentration 12.9
Avg. WPCF daily flow 0.997 Rolling average
Avg. daily pounds discharged 107

Percentage Change from previous year.
2009 115
2010 107 -7%
lbs.



INFLUENT NITROGEN ANALYSIS FOR CALENDAR YEAR 2010

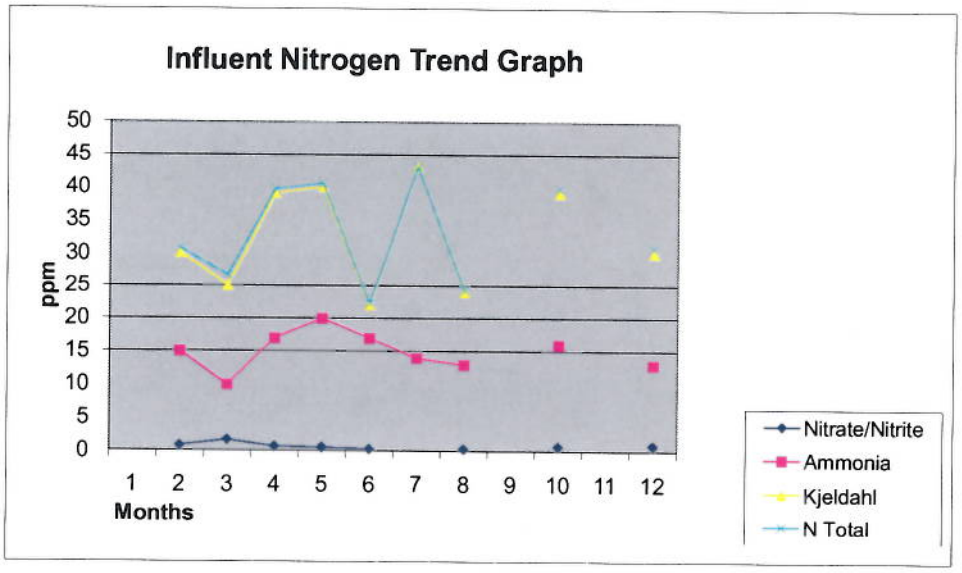
Total nitrogen = Nitrate/Nitrite + Kjeldahl

Date 2010	Nitrate/Nitrite	Ammonia	Kjeldahl	N Total
Jan.				
Feb.	0.74	15	30	30.7
Mar.	1.6	10	25	26.6
Apr.	0.63	17	39	39.6
May	0.48	20	40	40.5
June	0.26	17	22	22.3
July		14	43	43.0
Aug.	0.27	13	24	24.3
Sep.				
Oct.	0.68	16	39	39.7
Nov.				
Dec.	0.86	13	30	30.9
Avg.	0.7	15.0	32.4	33.1
Max.	1.6	20	43	43
Min.	0.26	10	22	22.26

Conversion lbs/day/mg/ppm 8.34

Avg. Total Nitrogen concentration 33.1
Avg. WPCF daily flow 0.997 Rolling average
Avg. daily pounds influent/raw 275

Percentage Change from previous year.
2009 0
2010 275 #DIV/0!
lbs.



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Water Enforcement, OES4-SMR
5 Post Office Square, Suite 100
Boston, MA 02109-3912

17 April 2014

APR 1 7 2014

RE: NPDES MA0100137, Annual Nitrogen Report, 2013

To whom it may concern:
In accordance with the NPDES Permit Part 1 H. Special Conditions the following information concerning nitrogen removal at the WPCF is provided.

The NPDES permit notes that "the annual average nitrogen load from this facility to the Connecticut River (2004-2005) is estimated to be 172 lbs/day."

History prior to 2013

2008

Efforts to reduce the discharge of Total Nitrogen into the Connecticut River began in 2008:

- Aeration tank flow changed from plug to stepped feed, 22 July 2008.
- Alkalinity changed from 2007 average = 85 ppm to 2008 = 109 ppm.
- Average annual discharge = 77 pounds.

2009

- 12 March, sludge age wasting calculation based on 8 days.
- 1 June, sludge age wasting calculation based on 9 days.
- 30 July, sludge age wasting calculation based on 11 days. Aeration tank dissolved oxygen setpoint changed from 1 ppm to .4 ppm.
- 17 November, sludge age wasting calculation based on 12 days.
- 2 December, sludge age wasting calculation based on 15 days.
- Average annual discharge = 115 pounds.

2010

- 23 March, increased sludge age to 13 days.
- 12 May, increased sludge age to 15 days.
- 3 July, increased sludge age to 17 days.
- 30 December increased sludge age to 20 days.
- Average annual discharge = 107 pounds.

2011

The average annual discharge to the Connecticut River = 109 pounds.

We continued to monitor effluent nitrogen concentrations and experiment with the process in 2011.

- Alternating the air and return activated sludge (RAS) to the aeration tanks (AT), 2, was initiated in November. This involved shutting off the air supply to one AT while continuing to pump RAS to that tank. The side that remained aerated received no RAS flow. Primary effluent continued to be fed to both AT's. The tank feeds, RAS & air, were then swapped at varying frequencies that depended upon process observation and testing. The goal of this effort is the reduction of nutrients to the Connecticut River.

2012

The average annual daily discharge to the Connecticut River = 60 pounds. This represents a 45% reduction from calendar year 2011.

- The changes in process made in 2011 were carried through into 2012.
- Valves operation was all done manually, labor intensive, until automated in August.
- 27 June, oxidation reduction potential (ORP) metering came on line with integration to the supervisory control and data acquisition system (SCADA).
- 13 August, installation of motorized valve actuators for the AT RAS and air valves; the system was integrated with SCADA.
- SCADA 4 modes of operation were programmed allowing operations staff to respond to varying process conditions while also providing the tools to continue experimentation to make the nutrient removal process more efficient.

2013

The average annual daily discharge to the Connecticut River = 76 pounds. This represents a 28% increase from calendar year 2012.

2 modifications:

- The first was the automation of the AT drain valves. We believe this may further advance nutrient reduction by allowing the option to drain mixed liquor suspended solids (MLSS) back to the primary effluent pump wet well where they will mix sooner with primary effluent.
- The second is the direct addition of RAS to the headworks to mix with raw sewage after the aerated grit chamber. We have observed two changes as the result of this, the first being a reduction of odors and significant bubbling or denitrification occurring in the primary clarifiers. During expected periods of wet weather the RAS to the headworks is discontinued until the event is over.

The automated valve operators were designed, fabricated and installed by facility staff. SCADA programming was done by Ames Electrical Consulting of Deerfield, MA.

One item that has made all the above very challenging is the variability of facility loadings. Though the number of residents served in Town is estimated to be about 7,400 we also have 3 significant industrial users. Their variability in production cycles and loadings associated do

not match typical residential diurnal loadings and so makes it difficult to nail down consistently lower effluent nutrient concentrations, and so we continue our efforts. Also beginning in June 2013 we began receiving and processing thickened sludge from other WWTP's in Franklin County.

During 2013, specifically for the period of June through December we increased the frequency of nutrient testing from 1 per month per the NPDES permit to weekly; a spreadsheet with the testing data results is included with this report. Though this is more costly as the samples are analyzed by a contract lab, Test America, we felt it necessary to obtain a larger number of samples to enable us to better evaluate the results of our efforts. We continue to work with Grant Weaver, The Water Planet Company, in the monitoring and adjusting of the process. We have been discussing the installation of more in-process monitoring instruments that could provide immediate real time indication of the changes we make in an effort to optimize nutrient removal. The instrumentation signals would be tied into the SCADA system for monitoring and to provide control to valves as desired for automatic control. Though this will not be inexpensive it would still be far less than a $4,000,000 estimated project cost as indicated in the Combined Sewer Overflow and Facilities Plan completed in 2005. A spreadsheet with the testing data results is included with this report.

Should you have any questions please contact me.

Respectfully,

Robert J. Trombley

Robert J. Trombley, Superintendent

pc: Town Administrator
Selectmen
WPCF Staff
DEP – Western Region

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Sampling Event #	Date	Flow (MGD)	Influent-Raw Sewage (mg/L)								Primary Effluent (mg/L)						Final Effluent (mg/L)							
			Total N	Kjeldahl	NH_3	org-N	NO_2-NO_3	BOD	TSS	PO_4	Total N	Kjeldahl	NH_3	org-N	NO_2-NO_3	PO_4	Total N	Kjeldahl	NH_3	org-N	NO_2-NO_3	BOD	TSS	PO_4
June	5	0.943	46	46	16	30	0.3	253	820	8	260	260	11	249	0.1	34	4.5	3.3	1.2	2.1	1.2	10	5	0.7
	12	1.331	44	43	14	29	0.9	1170	451	57	140	140	12	128	0.1	22	3.0	2.9	1.5	1.4	0.1	17	1	0.2
	19	1.285	36	36	24	12	0.1	581	806	24	100	100	20	80	0.1	23	4.0	3.6	2.2	1.4	0.4	10	6	0.1
	26	1.046	270	270	26	244	0.1	748	820	33	460	460	31	429	0.1	14	4.7	3.7	1.7	2.0	1.0	13	4	0.3
July	2	1.260	29	29	10	19	0.1	647	828	6	280	280	6	274	0.1	43	2.2	2.0	0.6	1.4	0.2	13	24	0.5
	10	1.052	270	270	38	232	0.1	690	778	38	660	660	24	636	0.1	110	4.8	4.6	1.9	2.7	0.2	22	67	0.6
	17	0.958	140	140	14	126	0.1	760	1029	40	510	510	9	501	0.1	91	6.4	6.3	1.3	5.0	0.1	14	53	1.4
	24	0.995	53	53	14	39	0.2	698	1070	12	371	370	10	360	0.8	68	3.5	3.3	1.0	2.3	0.2	16	8	0.5
	31	0.784	810	810	44	766	0.1	1203	1635	110	530	530	8	522	0.4	92	4.4	4.3	0.4	3.9	0.1	14	35	1.2
August	6	0.839	47	47	18	29	0.1	304	708	10	471	470	8	462	0.7	74	3.5	3.3	1.9	1.4	0.2	8	5	0.4
	14	0.908	54	54	16	38	0.1	792	633	12	510	510	7	503	0.4	90	11.4	11.0	0.9	10.1	0.4	15	11	1.2
	21	0.621	89	89	34	55	0.1	745	257	36	730	730	8	722	0.2	84	7.4	7.3	1.7	5.6	0.1	13	9	2.1
	28	0.843	21	21	8	13	0.3	306	597	4	180	180	8	172	0.2	71	2.5	1.6	0.4	1.2	0.9	13	11	0.4
September	4	0.815	92	92	20	72	0.1	956	357	11	530	530	9	521	0.1	100	3.5	3.4	0.9	2.5	0.1	11	17	0.7
	11	0.916	100	100	19	81	0.1	650	1143	14	550	550	7	543	0.2	110	2.3	2.2	0.4	1.9	0.1	14	31	1.2
	18	0.895	76	76	37	39	0.1	868	145	19	520	520	10	510	0.3	78	3.2	3.1	1.3	1.8	0.1	19	21	0.5
	24	0.855	120	120	27	93	0.1	1207	2722	10	580	580	10	570	0.3	89	7.0	6.8	5.2	1.6	0.2	39	14	0.9
October	2	0.670	25	25	13	12	0.1	640	2484	4	660	660	16	644	0.3	91	14.4	14.0	11.0	3.0	0.4	27	31	1.9
	9	0.785	47	47	10	37	0.1	469	1251	29	630	630	8	622	0.3	89	6.0	5.8	1.5	4.3	0.2	25	23	1.1
	16	0.781	54	54	35	19	0.1	517	4550	8	690	690	9	681	0.2	100	4.5	4.3	0.7	3.6	0.2	29	26	0.9
	23	0.960	0					1569	7182		310	310	10	300	0.1	110	4.4	4.3	1.5	2.8	0.1	21	46	1.1
	29	0.820	55	53	10	43	1.6	589	1013	16	350	350	5	345	0.2	85	6.3	6.1	1.7	4.4	0.2	34	28	0.7
November	6	0.869	130	130	16	114	0.1	1170	1118	38	440	440	42	398	0.2	94	16.2	16.0	0.8	15.2	0.2	42	28	1.8
	13	0.930	46	46	19	27	0.2	552	1210	7	340	340	7	333	0.1	50	5.8	5.7	1.2	4.5	0.1	21	17	0.7
	20	0.916	150	150	20	130	0.4	1848	705	16	630	630	9	621	0.4	81	13.1	13.0	0.2	12.8	0.1	28	36	2.1
	26	1.216	120	120	23	97	0.3	1871	2102	4	630	630	13	617	0.1	78	36.2	36.0	6.6	29.4	0.2	26	72	3.6
December	4	0.889	77	76	27	49	0.6	1406	445	12	350	350	15	335	0.1	56	15.4	15.0	13.0	2.0	0.4	29	20	0.7
	11	0.931	72	72	18	54	0.3	1890	1695	12	430	430	12	418	0.1	45	7.3	6.7	6.2	0.5	0.6	32	35	0.3
	18	0.930	66	66	13	53	0.3	1756	1111	10							7.7	7.6	6.2	1.4	0.1	21	43	0.6
	23	0.984	0					476	705		360	360	10	350	0.1	39	5.2	4.7	4.1	0.6	0.5	9	14	0.2
Average		0.934	105	112	21	91	0.2	911	1346	21	455	455	12	443	0.2	73	7.4	7.1	2.6	4.4	0.3	20	25	0.96
Median		**0.916**	**60**	**69**	**19**	**46**	**0.1**	**747**	**921**	**12**	**471**	**470**	**10**	462	0.2	**81**	5.0	4.7	1.5	2.4	0.2	**18**	**22**	**0.72**
Minimum		0.621	0	21	8	12	0.1	253	145	4	100	100	5	80	0.1	14	2.2	1.6	0.2	0.5	0.1	8	1	0.12
Maximum		1.331	810	810	44	766	1.6	1890	7182	110	730	730	42	722	0.8	110	36.2	36.0	13.0	29.4	1.2	42	72	3.6

Calendar Year 2014

CSO regulators weir elevation as of 2007:
7th & L St. 222.01 feet
Avenue A 181.10 ft.
Greenfield Rd. 143 ft.

		Flow control conditions		Precipitation Conditions								Total Q mgd		Peak Q mgd		
Annual	Date	Ave. A bufr line	Gfld Rd. Reg.	24 hr clock - rain		Rain - in.		Regulator Overflow - gal.			Sec. Q	Inf.	Sec.	Inf.	Sec.	Bypass
Event #	2014	outlet % open	valve % open	began	ended	WPCF	ADS	7th & L	Ave. A	Gfld Rd.	SP mgd	Pri.	Eff.	Pri.	Eff.	gal. mgd
1	6-Jan	100	50	10:02	15:02	0.8	1.08	0	0	2,719	3	1.49	1.36	2.65	3.37	0.000
2	12-Jan	100	50	0:11	2:27	0.81	0.82	0	0	939	3	1.16	1.01	1.72	1.87	0.000
3	21-Feb	100	50	0:00	0:00	0.40	0.42	0	0	0	2.2	1.16	1.07	1.30	2.94	0.130
4	12-Mar	100	50	15:46	23:47	0.58	0.52	0	0	17,326	2.2/1.7	1.69	0.75	2.98	2.25	0.346
5	20-Mar	100	50	0:00	15:43	0.71	0.70	0	0	1,429	3.0	1.82	1.34	3.57	3.00	0.000
6	29-Mar	100	50	17:10	0:00	1.74	1.67	0	0	44,804	2.2	2.00	1.15	3.13	1.30	0.259
7	30-Mar	100	50	0:00	0:00	0.76	0.49	0	0	2,072	3.0/2.0	1.85	1.55	3.17	2.35	0.604
						Total flow		-	-	69,289						

The secondary treatment plant flow design set point = 4 mgd. When the primary influent flow > the set point for > 5 minutes the wet weather system auto operation begins. The secondary treatment set point is adjustable.

Legend:

bufr = buffer, Gfld = Greenfield, Reg. = regulator, in. = inches, gal. = gallons, Sec. = secondary treatment, SP = setpoint, Inf. = influent, Pri. = primary treatment

		Flow control conditions		Precipitation Conditions								Total Q mgd		Peak Q mgd		
Annual	Date	Ave. A bufr line	Gfld Rd. Reg.	24 hr clock - rain		Rain - in.		Regulator Overflow - gal.			Sec. Q	Inf.	Sec.	Inf.	Sec.	Bypass
Event #	2014	outlet % open	valve % open	began	ended	WPCF	ADS	7th & L	Ave. A	Gfld Rd.	SP mgd	Pri.	Eff.	Pri.	Eff.	gal.
					Total flow			-	-	-						

ND = no data.

The secondary treatment plant flow design set point = 4 mgd. When the primary influent flow > the set point for > 5 minutes the wet weather system auto operation begins. The secondary treatment set point is adjustable.

Legend:

bufr = buffer, Gfld = Greenfield, Reg. = regulator, in. = inches, gal. = gallons, Sec. = secondary treatment, SP = setpoint, Inf. = influent, Pri. = primary treatment

Montague WWTP
Effluent flow estimate
Year **2014**
Month **March**

Manual Input

Day	6 Effluent Q Meter MGD	Bypass MGD	6 Est. Total Est. MGD	Comments
1	0.533		0.533	
2	0.481		0.481	
3	0.561		0.561	
4	0.542		0.542	
5	0.583		0.583	
6	0.653	0.123	0.776	
7	0.632		0.632	
8	0.639		0.639	
9	0.583		0.583	
10	0.586		0.586	
11	0.586		0.586	
12	0.751		0.751	
13	0.696	0.139	0.835	
14	0.672		0.672	
15	0.651		0.651	
16	0.650		0.650	
17	0.711		0.711	
18	0.622		0.622	
19	0.909	0.144	1.053	
20	1.344		1.344	
21	0.946		0.946	
22	0.885		0.885	
23	0.801		0.801	
24	0.942		0.942	
25	0.985		0.985	
26	1.060		1.060	
27	1.087		1.087	
28	1.040		1.040	
29	1.150		1.150	
30	1.550		1.550	
31	1.570		1.570	
Avg.	0.819	0.135	0.832	No plant water used for the entire
Max.	1.570	0.144	1.570	month.
Min.	0.481	0.123	0.481	

8 Daily MGD 7			
Max.		Min.	
Eff Meter	Est.	Eff. Meter	Est.
0.95	0.95	0.04	0.04
0.91	0.91	0.02	0.02
1.20	1.20	0.05	0.05
0.98	0.98	0.20	0.20
1.35	1.35	0.05	0.05
2.50	2.62	0.01	0.13
1.30	1.30	0.30	0.30
2.00	2.00	0.20	0.20
1.72	1.72	0.07	0.07
1.80	1.80	0.02	0.02
2.65	2.65	0.05	0.05
2.25	2.25	0.05	0.05
1.22	1.36	0.01	0.15
2.30	2.30	0.15	0.15
1.50	1.50	0.10	0.10
1.01	1.01	0.05	0.05
1.50	1.50	0.05	0.05
2.48	2.48	0.02	0.02
3.70	3.84	0.05	0.19
3.00	3.00	0.03	0.03
3.00	3.00	0.05	0.05
2.13	2.13	0.05	0.05
1.50	1.50	0.02	0.02
3.10	3.10	0.01	0.01
2.05	2.05	0.01	0.01
2.40	2.40	0.30	0.30
2.83	2.83	0.60	0.60
1.90	1.90	0.50	0.50
1.30	1.30	0.40	0.40
2.35	2.35	0.50	0.50
2.21	2.21	0.79	0.79

mar.6-14	Seconds		
Bucket test results:	5 gal. fill	GPM	24 hr. est.
- Sump Pump	3.5	86	123,429
- Plant water		#DIV/0!	#DIV/0!
TOTAL		#DIV/0!	#DIV/0!

mar.13-14			
Bucket test results:	5 gal. fill	GPM	24 hr. est.
- Sump Pump	3.1	96.77419	139,355
- Plant water		#DIV/0!	#DIV/0!
TOTAL		#DIV/0!	#DIV/0!

mar.19.14			
Bucket test results:	5 gal. fill	GPM	24 hr. est.
- Sump Pump	3	100	144,000
- Plant water		#DIV/0!	#DIV/0!
TOTAL		#DIV/0!	#DIV/0!

Bucket test results:	5 gal. fill	GPM	24 hr. est.
- Sump Pump		#DIV/0!	#DIV/0!
- Plant water		#DIV/0!	#DIV/0!
TOTAL		#DIV/0!	#DIV/0!

Flow Calculation Sheet

MONTH	Monthly Ave. Q	Calculated Annual Ave. Q		PREVIOUS 11 MO. Ave
Jan-13	0.911	0.858		0.853
Feb-13	0.908	0.853		0.848
Mar-13	1.061	0.862		0.844
Apr-13	1.52	0.921		0.867
May-13	0.926	0.926		0.926
Jun-13	1.205	0.953		0.930
Jul-13	0.92	0.969		0.974
Aug-13	0.818	0.969		0.983
Sep-13	0.807	0.969		0.983
Oct-13	0.768	0.956		0.973
Nov-13	0.876	0.965		0.973
Dec-13	1.876	1.050		0.975
Jan-14	0.87	1.046		1.062
Feb-14	0.823	1.039		1.059
Mar-14	0.833	1.020		1.037
Apr-14	0	0.894		0.975

2014	Average	Total	Average	Total		
March	pH	Gallons	% solids	dry tons	# loads	Disposal $
Ashfield	5.7	6,900	2.6%	0.76	1	$230.92
Charlemont	#DIV/0!	0	#DIV/0!	0.00	0	$0.00
Old Deerfield	5.4	9,000	4.2%	1.56	1	$473.48
South Deerfield	5.5	81,000	2.9%	9.96	9	$3,026.84
Erving	5.2	27,000	3.4%	3.77	3	$1,146.62
Greenfield	0.0	90,000	3.2%	0.00	0	$0.00
Hadley	6.1	108,000	2.1%	9.65	12	$2,932.14
Hatfield	6.3	18,000	5.8%	4.33	2	$1,317.75
Northfield	#DIV/0!	0	#DIV/0!	0.00	0	$0.00
Orange	5.7	36,000	3.8%	5.63	4	$1,711.37
Sunderland	6.2	36,000	2.3%	3.51	4	$1,066.75
Total		9,000		2.08	1	$633.21
Average	#DIV/0!	37,445	#DIV/0!	3.56	3.3	$1,082.35
Max.	#DIV/0!	108,000	#DIV/0!	9.96	12	$3,026.84
Min.	#DIV/0!	0	#DIV/0!	0.00	0	$0.00

Town of Montague

Water Pollution Control Facility
34 Greenfield Road
Montague MA 01351-9522
WPCFSUPT@MONTAGUE.NET

(413) 773-8865
FAX: (413) 774-6231

Environmental Protection Agency
Water Enforcement, OES4-SMR
5 Post Office Square, Suite 100
Boston, MA 02109-3912

20 March 2015

MAR 19 2015

RE: NPDES MA0100137, Annual Nitrogen Report, 2014

To whom it may concern:
In accordance with the NPDES Permit Part 1 H. Special Conditions the following information concerning nitrogen removal at the WPCF is provided.

The NPDES permit notes that "the annual average nitrogen load from this facility to the Connecticut River (2004-2005) is estimated to be 172 lbs/day."

History prior to 2014

2008
Efforts to reduce the discharge of Total Nitrogen into the Connecticut River began in 2008:
- Aeration tank flow changed from plug to stepped feed, 22 July 2008.
- Alkalinity changed from 2007 average = 85 ppm to 2008 = 109 ppm.
- Average annual discharge = 77 pounds.

2009
- 12 March, sludge age wasting calculation based on 8 days.
- 1 June, sludge age wasting calculation based on 9 days.
- 30 July, sludge age wasting calculation based on 11 days. Aeration tank dissolved oxygen setpoint changed from 1 ppm to .4 ppm.
- 17 November, sludge age wasting calculation based on 12 days.
- 2 December, sludge age wasting calculation based on 15 days.
- Average annual discharge = 115 pounds.

2010
- 23 March, increased sludge age to 13 days.
- 12 May, increased sludge age to 15 days.
- 3 July, increased sludge age to 17 days.
- 30 December increased sludge age to 20 days.
- Average annual discharge = 107 pounds.

2011

The average annual discharge to the Connecticut River = 109 pounds.

We continued to monitor effluent nitrogen concentrations and experiment with the process in 2011.

- Alternating the air and return activated sludge (RAS) to the aeration tanks (AT), 2, was initiated in November. This involved shutting off the air supply to one AT while continuing to pump RAS to that tank. The side that remained aerated received no RAS flow. Primary effluent continued to be fed to both AT's. The tank feeds, RAS & air, were then swapped at varying frequencies that depended upon process observation and testing. The goal of this effort is the reduction of nutrients to the Connecticut River.

2012

The average annual daily discharge to the Connecticut River = 60 pounds. This represents a 45% reduction from calendar year 2011.

- The changes in process made in 2011 were carried through into 2012.
- Valves operation was all done manually, labor intensive, until automated in August.
- 27 June, oxidation reduction potential (ORP) metering came on line with integration to the supervisory control and data acquisition system (SCADA).
- 13 August, installation of motorized valve actuators for the AT RAS and air valves; the system was integrated with SCADA.
- SCADA 4 modes of operation were programmed allowing operations staff to respond to varying process conditions while also providing the tools to continue experimentation to make the nutrient removal process more efficient.

2013

The average annual daily discharge to the Connecticut River = 76 pounds. This represents a 28% increase from calendar year 2012.

2 modifications:

- The first was the automation of the AT drain valves. We believe this may further advance nutrient reduction by allowing the option to drain mixed liquor suspended solids (MLSS) back to the primary effluent pump wet well where they will mix sooner with primary effluent.
- The second is the direct addition of RAS to the headworks to mix with raw sewage after the aerated grit chamber. We have observed two changes as the result of this, the first being a reduction of odors and significant bubbling or denitrification occurring in the primary clarifiers. During expected periods of wet weather the RAS to the headworks is discontinued until the event is over.

2014

The average annual daily discharge to the Connecticut River = 109 pounds. This represents a 43% increase from calendar year 2013 but is still less than the 2004-2005 estimate of 172 pounds per day, 37 % reduction. During calendar year 2014 we made three piping changes concerning the handling of sludge, they are as follows:

- Added a pipe to the gravity thickener drain line to permit the draining of the aeration tanks (2), secondary clarifiers (2) and the chlorine contact tank (2) to the head of the primary clarifiers.
- Added a pipe and valve to the return activated sludge (RAS) pump discharge manifold to allow the pumping of RAS directly to the headworks.
- Added a pipe to the thickened sludge pump discharge manifold to allow the pumping of RAS directly to the headworks.

This modification noted provides the option to feed the various flows to a point earlier in the process to begin the biological reduction of raw sewage components. These changes also allow us to recycle and thereby feed the system with sludges that become a food source for the plant process organisms. This is part of our sludge reduction efforts that to date have been very successful.

The variability of facility loadings makes process control very challenging. Though the number of residents served in Town is estimated to be about 7,400 we also have 3 significant industrial users. Their variability in production cycles and loadings associated do not match typical residential diurnal loadings and so makes it difficult to nail down consistently lower effluent nutrient concentrations, and so we continue our efforts. Also beginning in June 2013 we began receiving and processing thickened sludge from other WWTP's in Franklin County. We utilize septage and the outside sources of sludge to feed the sludge reduction process, attempting to level load the plant.

We continue to work with Grant Weaver, The Water Planet Company, in the monitoring, adjusting of the process and developing process control guidelines. We continue to discuss the installation of more in-process monitoring instruments that could provide immediate real time indication of the changes we make in an effort to optimize nutrient removal. The instrumentation signals would be tied into the SCADA system for monitoring and to provide control to valves as desired for automatic control. Though this will not be inexpensive it would still be far less than a $4,000,000 estimated project cost as indicated in the Combined Sewer Overflow and Facilities Plan completed in 2005. A spreadsheet with the effluent testing data for 2014 is included with this report.

Should you have any questions please contact me.

Respectfully,

Robert J. Trombley

Robert J. Trombley, Superintendent

pc: Town Administrator
Selectmen/Sewer Commission
WPCF Staff
File – EPA reports
DEP – Western Region

EFFLUENT NITROGEN ANALYSIS FOR CALENDAR YEAR 2014

Total nitrogen = Nitrate/Nitrite + Kjeldahl

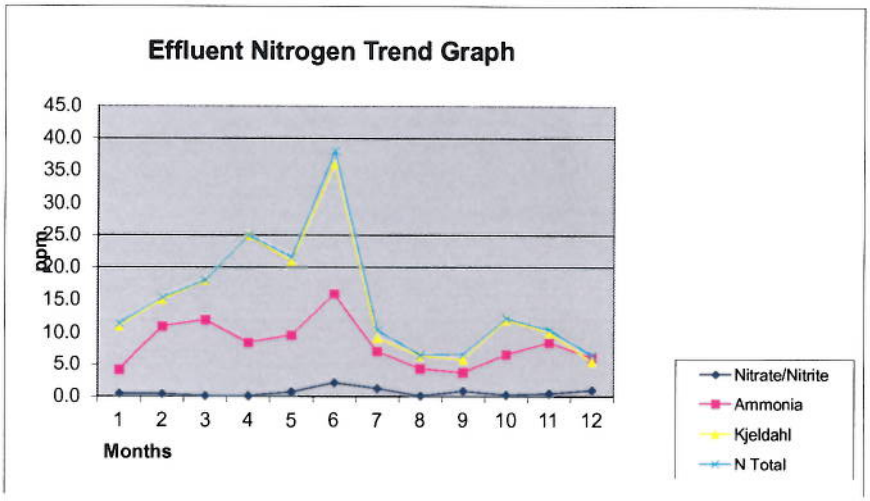
					WPCF	
2014	Nitrate/Nitrite	Ammonia	Kjeldahl	N Total	Q	N Tot. lbs
Jan	0.4	4.10	11.0	11.4	0.9	86
Feb	0.4	11.00	15.0	15.4	0.8	105
Mar	0.1	12.00	18.0	18	0.833	125
Apr	0.1	8.40	25.0	25	1.095	229
May	0.6	9.60	21.0	22	0.831	150
June	2.1	16.00	36.0	38	0.81	257
July	1.2	7.00	9.1	10	0.829	71
Aug.	0.1	4.30	6.3	6	0.779	41
Sep.	0.8	3.70	5.7	7	0.737	40
Oct	0.2	6.5	12	12	0.761	78
Nov	0.4	8.4	10	10	0.796	69
Dec	0.9	6.0	5	6.3	1.106	58
Avg.	0.6	8.1	14.5	15.1	0.9	109.2
Max.	2.1	16.0	36.0	38.1		257.4
Min.	0.1	3.7	5.4	6.3		40.0

Conversion lbs/day/mg/ppm 8.34

Avg. Total Nitrogen concentration 15.1
Avg. WPCF daily flow 0.858 Monthly A
Avg. daily pounds discharged 108

Conversion lbs/day/mg/ppm 8.34

Percentage Change from previous year.
2013 76
2014 109 43%
lbs.



Town of Montague

Water Pollution Control Facility
34 Greenfield Road
Montague MA 01351-9522
WPCFSUPT@MONTAGUE.NET

(413) 773-8865
FAX: (413) 774-6231

Environmental Protection Agency
Water Enforcement, OES4-SMR
5 Post Office Square, Suite 100
Boston, MA 02109-3912

15 March 2016

MAR 17 2016

RE: NPDES MA0100137, Annual Nitrogen Report, 2015

To whom it may concern:
In accordance with the NPDES Permit Part 1 H. Special Conditions the following information concerning nitrogen removal at the WPCF is provided.

The NPDES permit notes that "the annual average nitrogen load from this facility to the Connecticut River (2004-2005) is estimated to be 172 lbs/day."

History prior to 2015

2008
Efforts to reduce the discharge of Total Nitrogen into the Connecticut River began in 2008:

- Aeration tank flow changed from plug to stepped feed, 22 July 2008.
- Alkalinity changed from 2007 average = 85 ppm to 2008 = 109 ppm.
- Average annual discharge = 77 pounds.

2009

- 12 March, sludge age wasting calculation based on 8 days.
- 1 June, sludge age wasting calculation based on 9 days.
- 30 July, sludge age wasting calculation based on 11 days. Aeration tank dissolved oxygen setpoint changed from 1 ppm to .4 ppm.
- 17 November, sludge age wasting calculation based on 12 days.
- 2 December, sludge age wasting calculation based on 15 days.
- Average annual discharge = 115 pounds.

2010

- 23 March, increased sludge age to 13 days.
- 12 May, increased sludge age to 15 days.
- 3 July, increased sludge age to 17 days.
- 30 December increased sludge age to 20 days.
- Average annual discharge = 107 pounds.

2011

The average annual discharge to the Connecticut River = 109 pounds.

We continued to monitor effluent nitrogen concentrations and experiment with the process in 2011.

- Alternating the air and return activated sludge (RAS) to the aeration tanks (AT), 2, was initiated in November. This involved shutting off the air supply to one AT while continuing to pump RAS to that tank. The side that remained aerated received no RAS flow. Primary effluent continued to be fed to both AT's. The tank feeds, RAS & air, were then swapped at varying frequencies that depended upon process observation and testing. The goal of this effort is the reduction of nutrients to the Connecticut River.

2012

The average annual daily discharge to the Connecticut River = 60 pounds. This represents a 45% reduction from calendar year 2011.

- The changes in process made in 2011 were carried through into 2012.
- Valves operation was all done manually, labor intensive, until automated in August.
- 27 June, oxidation reduction potential (ORP) metering came on line with integration to the supervisory control and data acquisition system (SCADA).
- 13 August, installation of motorized valve actuators for the AT RAS and air valves; the system was integrated with SCADA.
- SCADA 4 modes of operation were programmed allowing operations staff to respond to varying process conditions while also providing the tools to continue experimentation to make the nutrient removal process more efficient.

2013

The average annual daily discharge to the Connecticut River = 76 pounds. This represents a 28% increase from calendar year 2012.

2 modifications:

- The first was the automation of the AT drain valves. We believe this may further advance nutrient reduction by allowing the option to drain mixed liquor suspended solids (MLSS) back to the primary effluent pump wet well where they will mix sooner with primary effluent.
- The second is the direct addition of RAS to the headworks to mix with raw sewage after the aerated grit chamber. We have observed two changes as the result of this, the first being a reduction of odors and significant bubbling or denitrification occurring in the primary clarifiers. During expected periods of wet weather the RAS to the headworks is discontinued until the event is over.

2014

The average annual daily discharge to the Connecticut River = 109 pounds. This represents a 43% increase from calendar year 2013 but is still less than the 2004-2005 estimate of 172 pounds per day, 37 % reduction. During calendar year 2014 we made three piping changes concerning the handling of sludge, they are as follows:

- Added a pipe to the gravity thickener drain line to permit the draining of the aeration tanks (2), secondary clarifiers (2) and the chlorine contact tank (2) to the head of the primary clarifiers.
- Added a pipe and valve to the return activated sludge (RAS) pump discharge manifold to allow the pumping of RAS directly to the headworks.
- Added a pipe to the thickened sludge pump discharge manifold to allow the pumping of RAS directly to the headworks.

This modification noted provides the option to feed the various flows to a point earlier in the process to begin the biological reduction of raw sewage components. These changes also allow us to recycle and thereby feed the system with sludges that become a food source for the plant process organisms. This is part of our sludge reduction efforts that to date have been very successful.

2015

We continued operations in 2015 similar to the scenario described in 2014. The average annual daily discharge to the Connecticut River = 81 pounds. This represents a 25% decrease from calendar year 2013 and when compared to the 2004-2005 estimate of 172 pounds per day, 53% reduction.

The variability of facility loadings makes process control very challenging. Though the number of residents served in Town is estimated to be about 7,400 we also have 3 significant industrial users. Their variability in production cycles and loadings associated do not match typical residential diurnal loadings and so makes it difficult to nail down consistently lower effluent nutrient concentrations, and so we continue our efforts. Also beginning in June 2013 we began receiving and processing thickened sludge from other WWTP's in Franklin County. We utilize septage and the outside sources of sludge to feed the sludge reduction process, attempting to level load the plant.

We continue to work with Grant Weaver, The Water Planet Company, in the monitoring, adjusting of the process and developing process control guidelines. We continue to discuss the installation of more in-process monitoring instruments that could provide immediate real time indication of the changes we make in an effort to optimize nutrient removal. The instrumentation signals would be tied into the SCADA system for monitoring and to provide control to valves as desired for automatic control. Though this will not be inexpensive it would still be far less than a $4,000,000 estimated project cost as indicated in the Combined Sewer Overflow and Facilities Plan completed in 2005. A spreadsheet with the effluent testing data for 2015 is included with this report.

Should you have any questions please contact me.

Respectfully,

Robert J Trombley

Robert J. Trombley, Superintendent

pc: Town Administrator

Selectmen/Sewer Commission
WPCF Staff
The Water Planet Company
File – EPA reports
DEP – Western Region

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EFFLUENT NITROGEN ANALYSIS FOR CALENDAR YEAR 2015

Total nitrogen = Nitrate/Nitrite + Kjeldahl

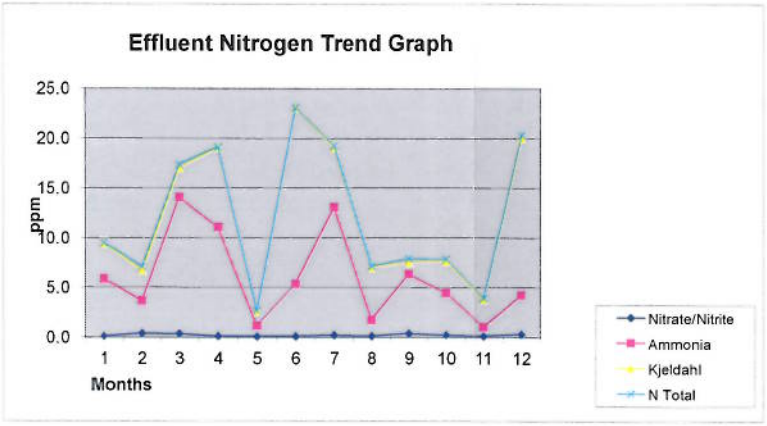
	Parts per Million				WPCF	
2015	Nitrate/Nitrite	Ammonia	Kjeldahl	N Total	Q,MGD	N Tot. lbs
Jan	0.1	5.80	9.4	9.5	0.833	66
Feb	0.4	3.60	6.7	7.1	0.753	44
Mar	0.3	14.00	17.0	17	0.891	129
Apr	0.1	11.00	19.0	19	0.824	131
May	0.1	1.10	2.6	3	0.73	16
June	0.1	5.30	23.0	23	0.822	158
July	0.2	13.00	19.0	19	0.795	127
Aug.	0.1	1.70	7.0	7	0.707	42
Sep.	0.4	6.30	7.5	8	0.829	54
Oct	0.2	4.4	7.6	8	0.842	55
Nov	0.1	0.97	3.8	3.9	0.721	23
Dec	0.3	4.2	20	20.3	0.768	130
Avg.	0.2	5.9	11.9	12.1	0.793	81.4
Max.	0.4	14.0	23.0	23.1		158.1
Min.	0.1	1.0	2.6	2.7		16.1

Conversion lbs/day/mg/ppm 8.34

Avg. Total Nitrogen concentration 12.1
Avg. WPCF daily flow 0.793 Monthly Average.
Avg. daily pounds discharged 80

Conversion lbs/day/mg/ppm 8.34

Percentage Change from previous year.
2014 109
2015 81 -25%
lbs.



Monthly Multiple Sample Average

		NO2,NO3	NH3	Kjeldahl
	AVG.	#DIV/0!	#DIV/0!	#DIV/0!
	Max.	0.0	0.0	0.0
	Min.	0.0	0.0	0.0